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# Proceedings of the American Street and Interurban Railway Association

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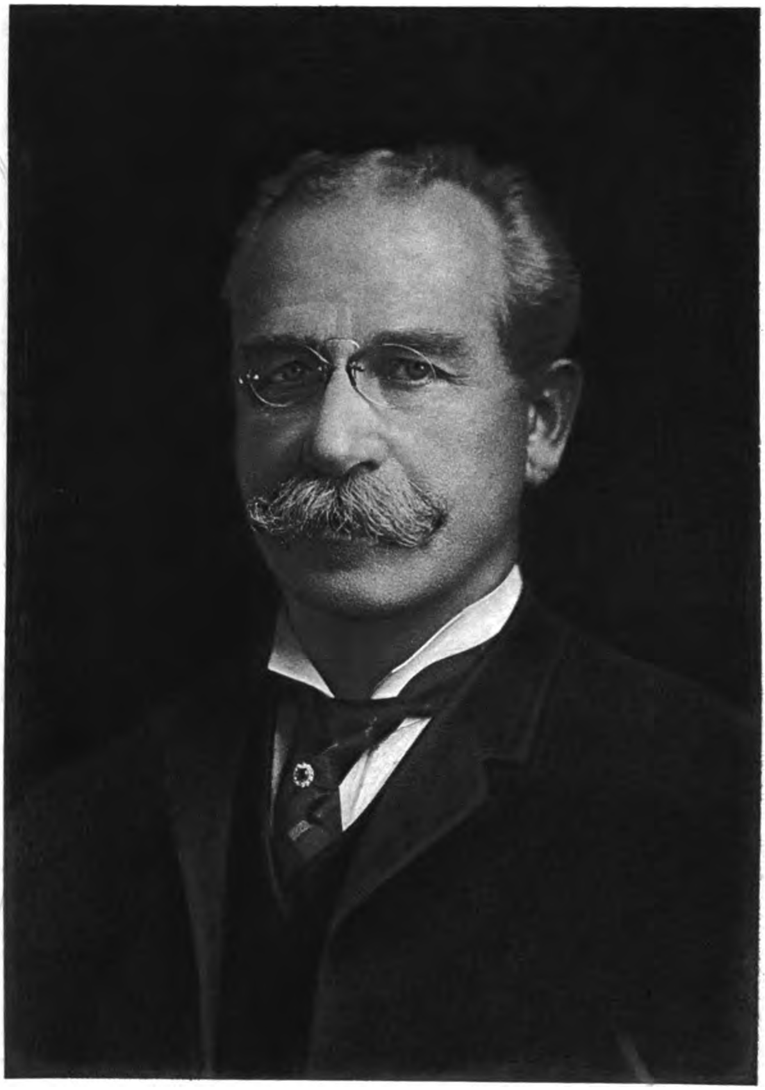

John I. Beggs

PRESIDENT 1906—1907

**JOHN I. BEGGS, PRESIDENT**

THE MILWAUKEE ELECTRIC RAILWAY AND LIGHT CO.
UNITED RAILWAYS CO. OF ST. LOUIS
MILWAUKEE, WIS.

# PROCEEDINGS

OF THE

# American Street and Interurban Railway Association

## 1907

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CONTAINING A COMPLETE REPORT OF THE TWENTY-SIXTH ANNUAL CONVENTION HELD AT THE STEEL PIER, ATLANTIC CITY, N. J., OCTOBER 16, 17, 18, 1907

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PUBLISHED BY THE ASSOCIATION FROM THE OFFICE
OF THE SECRETARY

29 WEST 39TH STREET, NEW YORK, N. Y.

THE NAME OF THIS ASSOCIATION WAS FORMERLY THE

AMERICAN STREET RAILWAY ASSOCIATION.

ORGANIZED AT BOSTON, MASS., DECEMBER 13, 1882.

REORGANIZED AT PHILADELPHIA, PA., SEPTEMBER 27, 1905.

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## OFFICERS, 1906-07.

(Officers of the 1907 Convention.)

PRESIDENT:

**JOHN I. BEGGS,**

President, The Milwaukee Elec. Ry. & Lt. Co., United Rys. Co. of St. Louis,

MILWAUKEE, WIS.

FIRST VICE-PRESIDENT:

**CALVIN G. GOODRICH,**

Vice-President, Twin City Rapid Transit Co.,

MINNEAPOLIS, MINN.

SECOND VICE-PRESIDENT:

**JAMES F. SHAW,**

President, Boston & Worcester Electric Cos.,

BOSTON, MASS.

THIRD VICE-PRESIDENT:

**ARTHUR W. BRADY,**

President, Indiana Union Traction Co.,

ANDERSON, IND.

SECRETARY-TREASURER:

**BERNARD V. SWENSON,**

29 WEST THIRTY-NINTH STREET, NEW YORK, N. Y.

---

### EXECUTIVE COMMITTEE:

PRESIDENT, VICE-PRESIDENTS AND

C. L. S. Tingley, 2d Vice-President, American Railways Co. (President American Street and Interurban Railway Accountants' Association), Philadelphia, Pa.

H. H. ADAMS, Superintendent of Shops, The United Railways and Electric Co. (President American Street and Interurban Railway Engineering Association), Baltimore, Md.

HENRY C. BRADLEY, Claim Adjuster, Chicago Union Traction Co. (Acting President American Street and Interurban Railway Claim Agents' Association), Chicago, Ill.

## OFFICERS, 1907-08.

(Elected at the 1907 Convention.)

PRESIDENT:

**CALVIN G. GOODRICH,**
Vice-President, Twin City Rapid Transit Co.,
MINNEAPOLIS, MINN.

FIRST VICE-PRESIDENT:

**JAMES F. SHAW,**
President, Boston & Worcester Electric Cos.,
BOSTON, MASS.

SECOND VICE-PRESIDENT:

**ARTHUR W. BRADY,**
President, Indiana Union Traction Co.,
ANDERSON, IND.

THIRD VICE-PRESIDENT:

**THOMAS N. McCARTER,**
President, Public Service Railway Co.,
NEWARK, N. J.

SECRETARY-TREASURER:

**BERNARD V. SWENSON,**
29 WEST THIRTY-NINTH STREET, NEW YORK, N. Y.

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### EXECUTIVE COMMITTEE:

PRESIDENT, VICE-PRESIDENTS AND

FRANK R. HENRY, Auditor, United Railways Co. of St. Louis (President American Street and Interurban Railway Accountants' Association), St. Louis, Mo.

FRED G. SIMMONS, Superintendent of Construction and Maintenance of Way, The Milwaukee Electric Railway & Light Co. (President American Street and Interurban Railway Engineering Association), Milwaukee, Wis.

H. R. GOSHORN, General Claim Agent, Philadelphia Rapid Transit Co. (President American Street and Interurban Railway Claim Agents' Association), Philadelphia, Pa.

## COMMITTEES, 1906–1907.

---

### Membership.

H. H. Vreeland, *Chairman,* President New York City Railway Co., New York, N. Y.

C. S. Sergeant, Vice-President Boston Elevated Railway Co., Boston, Mass.

W. Caryl Ely, President Ohio Valley Finance Co., Buffalo, N. Y.

E. C. Foster, President New Orleans Railway & Light Co., New Orleans, La.

H. J. McGowan, President Indianapolis Traction & Terminal Co., Indianapolis, Ind.

James H. McGraw, President Street Railway Journal, New York, N. Y.

Hugh M. Wilson, President Electric Railway Review, Chicago, Ill.

W. G. Ross, Managing Director Montreal Street Railway Co., Montreal, Quebec.

W. A. House, President United Railways & Electric Co., Baltimore, Md.

T. K. Glenn, Vice-President Georgia Railway & Electric Co., Savannah, Ga.

### Compensation for Carrying U. S. Mail.

G. T. Rogers, *Chairman,* President Binghamton Railway Co., Binghamton, N. Y.

Capt. Robert McCullough, Vice-President United Railways Co. of St. Louis, St. Louis, Mo.

Gen. G. H. Harries, Vice-President Washington Railway & Electric Co., Washington, D. C.

P. F. Sullivan, President Boston & Northern Street Railway Co., Boston, Mass.

### Subjects.

Richard McCullough, Chairman, Assistant General Manager, United Railways Co. of St. Louis, St. Louis, Mo.

Ernest Gonzenbach, General Manager, Sheboygan Light, Power and Railway Co., Sheboygan, Wis.

R. E. Danforth, General Manager, Public Service Corporation of New Jersey, Newark, N. J.

C. L. S. Tingley, President Accountants' Association, Philadelphia, Pa.

H. H. Adams, President Engineering Association, Baltimore, Md.

B. B. Davis, Secretary, Claim Agents' Association, Columbus, O.

*Committees* — (Continued).

### Car Wiring.

JOHN W. CORNING, *Chairman,* Electrical Engineer Boston Elevated Railway Co., Boston, Mass.

C. B. KING, General Manager London Street Railway Co., London, Ontario.

L. P. CRECELIUS, Engineer Forest City Railway Co., Cleveland, Ohio.

HUGH HAZELTON, Electrical Engineer, 32 Park Place, New York, N. Y.

I. D. SHIPPER, Electrical Engineer J. G. Brill Co., Philadelphia, Pa.

### Standardization.

H. C. PAGE, *Chairman,* General Manager Springfield Street Railway Co., Springfield, Mass.

T. W. WILSON, General Manager International Railway Co., Buffalo, N. Y.

JOHN MURPHY, General Superintendent Pittsburg Railways Co., Pittsburg, Pa.

H. A. NICHOLL, General Manager Indiana Union Traction Co., Anderson, Ind.

W. H. EVANS, Master Mechanic International Railway Co., Buffalo, N. Y.

### Insurance.

H. J. DAVIES, *Chairman,* Secretary Cleveland Electric Railway Co., Cleveland, Ohio.

C. O. KRUGER, Second Vice-President Philadelphia Rapid Transit Co., Philadelphia, Pa.

G. L. ESTABROOK, Secretary and Treasurer East St. Louis & Suburban Railway Co., Philadelphia, Pa.

A. H. Ford, President Birmingham Railway, Light & Power Co., Birmingham, Ala.

R. B. STEARNS, General Manager Chicago & Milwaukee Electric Railway Co., Highwood, Ill.

### Promotion of Traffic.

W. E. HARRINGTON, *Chairman,* President Pottsville Union Traction Co., Pottsville, Pa.

HOWARD F. GRANT, Manager Seattle Electric Co., Seattle, Wash.

H. E. REYNOLDS, Assistant General Manager Boston & Northern Street Railway Co., Boston, Mass.

H. J. CROWLEY, General Manager American Railways Co., Philadelphia, Pa.

G. W. PARKER, General Passenger Agent Detroit United Railways, Detroit, Mich.

*Committees* — (Continued).

### Heavy Electric Traction.

CALVERT TOWNLEY, *Chairman,* Vice-President New York, New Haven & Hartford R. R. Co., New Haven, Conn.

E. B. KATTE, Electrical Engineer New York Central & Hudson River R. R. Co., New York, N. Y.

L. B. STILLWELL, Consulting Engineer, New York, N. Y.

### Standard Code of Rules.

E. G. CONNETTE, *Chairman,* General Manager Worcester Consolidated Street Railway Co., Worcester, Mass.

E. C. Faber, General Manager Aurora, Elgin & Chicago Electric Railroad Co., Wheaton, Ill.

E. J. RYON, Superintendent Schenectady Railway Co., Schenectady, N. Y.

J. N. SHANNAHAN, General Manager Washington, Baltimore & Annapolis Electric Railway Co., Baltimore, Md.

### Municipal Ownership.

C. D. WYMAN, *Chairman,* General Manager Stone & Webster, Boston, Mass.

JOHN A. BEELER, General Manager Denver City Tramway Co., Denver, Colo.

H. M. SLOAN, General Manager Calumet Electric Street Railway Co., Chicago, Ill.

J. J. STANLEY, General Manager Cleveland Electric Railway Co., Cleveland, Ohio.

### Public Relations.

W. CARYL ELY, *Chairman,* President Ohio Valley Finance Co., Buffalo, N. Y.

JOHN B. PARSONS, President Philadelphia Rapid Transit Co., Philadelphia, Pa.

CHARLES W. WETMORE, Vice-President The Milwaukee Electric Railway & Light Co., Milwaukee, Ill.

JERE C. HUTCHINS, President Detroit United Railway, Detroit, Mich.

HENRY A. ROBINSON, General Solicitor New York City Railway Co., New York, N. Y.

E. C. FOSTER, President New Orleans Railway & Light Co., New Orleans, La.

*Committees* — (Continued).

### Car House Construction.

H. H. Adams, *Chairman,* Superintendent of Shops United Railways & Electric Co., Baltimore, Md.

E. J. Cook, General Manager Rochester Railway Co., Rochester, N. Y.

C. F. Ferrin, Architect Twin City Rapid Transit Co., Minneapolis, Minn.

L. H. Parker, Engineering Department Stone & Webster Co., Boston, Mass.

A. V. Porter, Architect New York City Railway Co., New York, N. Y.

Thomas Pumfrey, Civil Engineer International Railway Co., Buffalo, N. Y.

## PRESIDENTS OF THE ASSOCIATION SINCE ORGANIZATION.

| | |
|---|---|
| 1882–83 | H. H. Littell. |
| 1883–84 | William H. Hazzard.* |
| 1884–85 | Calvin A. Richards.* |
| 1885–86 | Julius S. Walsh. |
| 1886–87 | Thomas W. Ackley.* |
| 1887–88 | Charles B. Holmes. |
| 1888–89 | George B. Kerper. |
| 1889–90 | Thomas Lowry. |
| 1890–91 | Henry M. Watson. |
| 1891–92 | John G. Holmes.* |
| 1892–93 | D. F. Longstreet. |
| 1893–94 | Henry C. Payne.* |
| 1894–95 | Joel Hurt. |
| 1895–96 | H. M. Littell. |
| 1896–97 | Robert McCulloch. |
| 1897–98 | Albion E. Lang. |
| 1898–99 | Charles S. Sergeant. |
| 1899–1900 | John M. Roach. |
| 1900–01 | Walter H. Holmes. |
| 1901–02 | Herbert H. Vreeland. |
| 1902–03 | Jere C. Hutchins. |
| 1903–04 | W. Caryl Ely. |
| 1904–05 | W. Caryl Ely. |
| 1905–06 | W. Caryl Ely. |
| 1906–07 | John I. Beggs. |
| 1907–08 | Calvin G. Goodrich. |

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* Deceased.

## CONVENTIONS OF THE ASSOCIATION SINCE ORGANIZATION.

1882 — Boston, Mass., Organization Meeting, December 12–13
1883 — Chicago, Ill. ........................ October 9–10
1884 — New York, N. Y. ................. October 15–17
1885 — St. Louis, Mo. ..................... October 21–23
1886 — Cincinnati, O. ..................... October 20–21
1887 — Philadelphia, Pa. ................. October 19–20
1888 — Washington, D. C. ................ October 17–18
1889 — Minneapolis, Minn. ................ October 16–17
1890 — Buffalo, N. Y. ...................... October 15–16
1891 — Pittsburg, Pa ........................ October 21–22
1892 — Cleveland, O. ...................... October 19–20
1893 — Milwaukee, Wis. ................... October 18–19
1894 — Atlanta, Ga. ........................ October 17–19
1895 — Montreal, Quebec ................. October 15–18
1896 — St. Louis, Mo. ..................... October 20–23
1897 — Niagara Falls, N. Y. .............. October 19–22
1898 — Boston, Mass. ...................... September 6–9
1899 — Chicago, Ill. ........................ October 17–20
1900 — Kansas City, Mo. .................. October 16–19
1901 — New York, N. Y. .................... October 9–11
1902 — Detroit, Mich. ...................... October 8–10
1903 — Saratoga Springs, N. Y. ........... September 2–4
1904 — St. Louis, Mo. ..................... October 12–13
1905 — Philadelphia, Pa. ................. September 27–28
1906 — Columbus, O. ...................... October 15–19
1907 — Atlantic City, N. J. ................ October 14–18

# OFFICERS SINCE ORGANIZATION.

## OFFICERS, ORGANIZATION MEETING.

(American Street Railway Association.)

*Chairman:*
*MOODY MERRILL,
President, Highland Street Railway Co., Boston, Mass.

*Secretaries:*
CHAUNCEY C. WOODWORTH,
Secretary, Rochester City & Brighton Railroad Co., Rochester, N. Y.
CHARLES B. CLEGG,
President, Oakwood & Dayton Street Railway Co., Dayton, O.
Elected at Boston, Mass., December 12, 1882.

## OFFICERS, 1882-1883.

*President:*
H. H. LITTELL,
General Manager, Louisville City Railway Co., Louisville, Ky.

*First Vice-President:*
*WILLIAM H. HAZZARD,
President, Brooklyn City Railroad Co., Brooklyn, N. Y.

*Second Vice-President:*
*CALVIN A. RICHARDS,
President, Metropolitan Railroad Co., Boston, Mass.

*Third Vice-President:*
GEORGE B. KERPER,
President, Mount Adams & Eden Park Inclined Railway, Cincinnati, O.

*Secretary and Treasurer:*
* WILLIAM J. RICHARDSON,
Secretary, Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:
President, Vice-Presidents and
Julius S. Walsh, Pres., Citizens' Railway Co....................St. Louis, Mo.
Charles Cleminshaw, Vice-Pres., Troy & Lansingburgh Railroad Co., Troy, N. Y.
Thomas Lowry, Pres., Minneapolis Street Railway Co........Minneapolis, Minn.
James K. Lake, Supt., Chicago West Division Railway .............Chicago, Ill.
Daniel F. Longstreet, Gen. Man., Union Railroad Co..........Providence, R. I.
Elected at Boston, Mass., December 13, 1882.

## OFFICERS, 1883-1884.

*President:*
*WILLIAM H. HAZZARD,
President, Brooklyn City Railroad Co., Brooklyn, N. Y.

*First Vice-President:*
JAMES K. LAKE,
Superintendent, Chicago West Division Railway, Chicago, Ill.

*Second Vice-President:*
GEORGE B. KERPER,
President, Mount Adams & Eden Park Inclined Railway, Cincinnati, O.

*Third Vice-President:*
DANIEL F. LONGSTREET,
General Manager, Union Railway Co., Providence, R. I.

*Secretary and Treasurer:*
* WILLIAM J. RICHARDSON,
Secretary, Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:
President, Vice-Presidents and
H. H. Littell, Gen. Man., Louisville City Railway Co.............Louisville, Ky.
*John G. Holmes, Pres., Citizens' Street Railroad Co..............Pittsburg, Pa.
Julius E. Rugg, Supt., Highland Street Railroad..................Boston, Mass.
Pierre C. Maffitt, Pres., Missouri Railroad Co............ .......St. Louis, Mo.
*Jacob Sharp, Pres., Twenty-third Street Railway Co..........New York, N. Y.
Elected at Chicago, Ill., October 10, 1883.

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*Deceased.

## OFFICERS, 1884-1885.

*President:*
*CALVIN A. RICHARDS,
President, Metropolitan Railroad Co., Boston, Mass.

*First Vice-President:*
JULIUS S. WALSH,
President, Citizens' Railway Co.,
St. Louis, Mo.

*Second Vice-President:*
HENRY M. WATSON,
President, Buffalo Street Railroad Co.,
Buffalo, N. Y.

*Third Vice-President:*
EDWARD LUSHER,
Secretary and Treasurer, Montreal City Passenger Railway Co., Montreal, Quebec.

*Secretary and Treasurer:*
* WILLIAM J. RICHARDSON,
Secretary, Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:
President, Vice-Presidents and
*William H. Hazzard, Pres., Brooklyn City Railroad Co.........Brooklyn, N. Y.
James K. Lake, Supt., Chicago West Division Railway.............Chicago, Ill.
*Charles J. Harrah, Pres., People's Passenger Railway Co.......Philadelphia. Pa.
*William White, Pres., Dry Dock, E. Broadway & B. Railroad Co.New York, N.Y.
B. du Pont, Pres., Central Passenger Railroad Co...............Louisville, Ky.
Elected at New York, N. Y., October 17, 1884.

## OFFICERS, 1885-1886.

*President:*
JULIUS S. WALSH,
President, Citizens' Railway Co., St. Louis, Mo.

*First Vice-President:*
* WILLIAM WHITE;
President, Dry Dock, E. Broadway & B. Railroad Co., New York, N. Y.

*Second Vice-President:*
CHARLES B. HOLMES,
President, Chicago City Railway Co., Chicago, Ill.

*Third Vice-President:*
* SAMUEL LITTLE,
Treasurer, Highland Street Railway Co., Boston, Mass.

*Secretary and Treasurer:*
WILLIAM J. RICHARDSON.
Secretary, Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:
President, Vice-Presidents and
*Calvin A. Richards, Pres., Metropolitan Railroad Co..............Boston, Mass.
John Kilgour, Pres., Cincinnati Street Railway Co..............Cincinnati, O.
John Maguire, Pres., City Railroad Co............................Mobile, Ala.
*Thomas W. Ackley, Pres., 13th and 15th Streets Pass. Railway Co.Philadelphia,Pa.
Chauncey C. Woodworth, Sec., Rochester City & B. Railroad Co.Rochester, N. Y.
Elected at St. Louis, Mo., October 23, 1885.

## OFFICERS, 1886-1887.

*President:*
*THOMAS W. ACKLEY,
President, 13th and 15th Streets Pasenger Railway Co., Philadelphia, Pa.

*First Vice-President:*
ALBERT G. CLARK,
Vice-President, Cincinnati Street Railway Co., Cincinnati, O.

*Second Vice-President:*
* WILLIAM H. SINCLAIR,
President. Galveston City Railroad Co., Galveston, Tex.

*Third Vice-President:*
PRENTISS CUMMINGS,
President, Cambridge Railroad Co., Cambridge, Mass.

*Secretary and Treasurer:*
WILLIAM J. RICHARDSON,
Secretary, Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:
President, Vice-Presidents and
Julius S. Walsh, Pres., Citizens' Railway Co...................St. Louis, Mo.
Henry Hurt, Pres., Washington & Georgetown Railroad Co..Washington, D. C.
*C. Densmore Wyman, Vice-Pres., Central Park, N. & E. River Railroad Co. N. Y.
*A. Everett, Pres., East Cleveland Railroad Co..................Cleveland, Ohio.
Samuel S. Spaulding, Pres., East Side Street Railroad Co........Buffalo, N. Y.
Elected at Cincinnati, O., October 21, 1886.

---

*Deceased.

## OFFICERS, 1887-1888.

*President:*

**CHARLES B. HOLMES,**

President, Chicago City Railway Co., Chicago, Ill.

*First Vice-President:*

**JULIUS E. RUGG,**

General Superintendent, Boston Consolidated Street Railway, Boston, Mass.

*Second Vice-President:*

* **R. DUDLEY FRAYSER,**

President, Memphis City Railway Co., Memphis, Tenn.

*Third Vice-President:*

**CHARLES B. CLEGG,**

Director, Dayton Street Railroad Co., Dayton, O.

*Secretary and Treasurer:*

* **WILLIAM J. RICHARDSON,**

Secretary, Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and

*Thomas W. Ackley, Pres., 13th and 15th Streets Pass. Railway Co. Philadelphia, Pa.
*Winfield Smith, Pres., Cream City Railroad Co..............Milwaukee, Wis.
*Charles Green, Pres., People's Railway Co......................St. Louis, Mo.
Edward G. Mosher, Supt., Augusta & Summerville Railroad.......Augusta, Ga.

Elected at Philadelphia, Pa., October 20, 1887.

## OFFICERS, 1888-1889.

*President:*

**GEORGE B. KERPER,**

President, Mount Adams & Eden Park Inclined Railway, Cincinnati, O.

*First Vice-President:*

**JESSE METCALF,**

President, Union Railroad Co., Providence, R. I.

*Second Vice-President:*

**HENRY HURT,**

President, Washington & Georgetown Railroad Co., Washington, D. C.

*Third Vice-President:*

**WILLIAM H. MARTIN,**

Vice-President, Ferries & Cliff House Railway Co., San Francisco, Cal.

*Secretary and Treasurer:*

* **WILLIAM J. RICHARDSON,**

Secretary, Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and

Charles B. Holmes, Pres., Chicago City Railway Co................Chicago, Ill.
John Scullin, Pres., Union Depot Railroad Co...................St. Louis, Mo.
James H. Johnston, Pres., City & Suburban Railway Co..........Savannah, Ga.
Henry A. Sage, Pres., Easton, S. Easton & W. E. Pass. Railway Co..Easton, Pa.
Edward J. Lawless, Supt. Metropolitan Street Railway.........Kansas City, Mo.

Elected at Washington, D. C., October 18, 1888.

## OFFICERS, 1889-1890.

*President:*

**THOMAS LOWRY,**

President, Minneapolis & St. Paul Street Railway Cos., Minneapolis, Minn.

*First Vice-President:*

***C. DENSMORE WYMAN,**

Vice-President, Central Park, North & East River Railroad Co., New York, N. Y.

*Second Vice-President:*

**JOHN C. SHAFFER,**

President Citizens' Street Railroad Co., Indianapolis, Ind.

*Third Vice-President:*

**ROBERT McCULLOCH,**

General Manager, Citizens', St. Louis, Cass Avenue & Fair Grounds, and Benton-Bellefontaine Railways, St. Louis, Mo.

*Secretary and Treasurer:*

* **WILLIAM J. RICHARDSON,**

Secretary, Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and

George B. Kerper, Pres., Mt. Adams & E. P. Inc. Railway Co ...Cincinnati, O.
George W. Kiely, Man. Dir., Toronto Street Railway Co.....Toronto, Ontario.
Frank H. Monks, Gen. Man., West End Street Railway Co......Boston, Mass.
Raphael Semmes, Supt., Citizens' Street Railroad................Memphis, Tenn.
Francis M. Eppley, Pres., Orange Cross-Town & B. Railway Co....Orange, N. J.

Elected at Minneapolis, Minn., October 17, 1889.

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*Deceased.

## OFFICERS, 1890-1891.

*President:*

**HENRY M. WATSON,**

President Buffalo Street Railroad, and Buffalo East Side Street Railway, Cos., Buffalo, N. Y.

*First Vice-President:*

WILLIAM A. SMITH,

General Manager, Omaha Street Railway Co., Omaha, Neb.

*Second Vice-President:*

CHARLES ODELL,

President, ..ewburyport & Amesbury Street Railroad Co., Newburyport, Mass.

*Third Vice-President:*

ANDREW D. ROGERS,

President, Columbus Consolidated Street Railroad Co., Columbus O.

*Secretary and Treasurer:*

* WILLIAM J. RICHARDSON,

Secretary, Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and

Thomas Lowry, Pres. Minneapolis and St. Paul Street R'y Cos.Minneapolis, Minn.
David F. Henry, Pres. Federal Street & P. V. Pass. Railway Co. ..Pittsburg, Pa.
Albert E. Thornton, Director Atlanta Street Railroad Co............Atlanta, Ga.
Harvey M. Littell, Gen. Man. Cincinnati Inclined Plane R'y Co....Cincinnati, O.
Thomas C. Keefer, President Ottawa City Pass Railway Co......Ottawa, Quebec.

Elected at Buffalo, N. Y., October 16, 1890.

## OFFICERS, 1891-1892.

*President:*

*JOHN G. HOLMES,

President Citizens' Traction Co., Pittsburg, Pa.

*First Vice-President:*

* THOMAS H. McLEAN,

Secretary, Twenty-third Street Railway Co., New York, N. Y.

*Second Vice-President:*

JAMES B. SPEED,

President, Louisville City Railway Co., Louisville, Ky.

*Third Vice-President:*

ALBION E. LANG,

Vice-President, Toledo Consolidated Street Railway Co., Toledo, O.

*Secretary and Treasurer:*

* WILLIAM J. RICHARDSON,

Secretary, Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and

Henry M. Watson, President Buffalo Railway Co................Buffalo, N. Y.
Lewis Perrine, Jr., Pres. Trenton Pass. Railway Co. Consolidated..Trenton, N. J.
W. Worth Bean, President St. Joseph & Benton Harbor R'y Co..St. Joseph, Mich.
Murry A. Verner, Pres. Pittsburg & Birmingham Traction Co....Pittsburg, Pa.
Thomas C. Penington, Treasurer Chicago City Railway Co........Chicago, Ill.

Elected at Pittsburg, Pa., October 22, 1891.

## OFFICERS, 1892-1893.

*President:*

D. F. LONGSTREET,

Vice-Pres. and Gen. Man. West End Street Railroad Co., Denver, Col.

*First Vice-President:*

* A. EVERETT,

President East Cleveland Railroad Co., Cleveland, O.

*Second Vice-President:*

JOEL HURT,

President Atlanta Consolidated Street Railroad Co., Atlanta, Ga.

*Third Vice-President:*

W. WORTH BEAN,

President St. Joseph & Benton Harbor Electric Railway Co., St. Joseph, Mich.

*Secretary and Treasurer:*

* WILLIAM J. RICHARDSON,

Secretary and Treasurer Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and

*John G. Holmes, President Citizens' Traction Co................Pittsburg, Pa.
John D. Crimmins, President Metropolitan Traction Co......New York, N. Y.
Thomas J. Minary, General Manager Louisville Railway Co......Louisville, Ky.
James R. Chapman, Vice-Pres. Consolidated St. Railway Co.Grand Rapids, Mich.
Benjamin E. Charlton, President Hamilton Street Railway Co....Hamilton, Ont.

Elected at Cleveland, O., October 20, 1892.

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*Deceased.

## OFFICERS, 1893-1894.

*President:*
*HENRY C. PAYNE,
Vice-President, Milwaukee Street Railway Co., Milwaukee, Wis.

*First Vice-President:*
*WILLIAM J. STEPHENSON,
President Metropolitan Railroad Co.,
Washington, D. C.

*Second Vice-President:*
JAMES R. CHAPMAN,
Vice-President, Consolidated Street Railway Co., Grand Rapids, Mich.

*Third Vice-President:*
LEWIS PERRINE, Jr.,
President Trenton Passenger Railway Co., Consolidated, Trenton, N. J.

*Secretary and Treasurer:*
*WILLIAM J. RICHARDSON,
Secretary and Treasurer, Atlantic Avenue Railroad Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE:
President, Vice-Presidents and
D. F. Longstreet, Vice-President West End Street Railway Co....Denver, Col.
*Thomas H. McLean, Gen. Man. Citizens' Street Railroad Co.Indianapolis, Ind.
Edwards Whitaker, President Lindell Railway Co..............St. Louis, Mo.
W. Y. Soper, President Ottawa Electric Street Railway Co...Ottawa, Quebec
E. S. Goodrich, President Hartford Street Railway Co.........Hartford, Conn.
Elected at Milwaukee, Wis., October 19, 1893.

## OFFICERS, 1894-1895.

*President:*
JOEL HURT,
President, Atlanta Consolidated Street Railway Co., Atlanta, Ga.

*First Vice-President:*
W. WORTH BEAN,
President St. Joseph & Benton Harbor Electric Railway & Light Co., St. Joseph, Mich.

*Second Vice-President:*
JOHN H. CUNNINGHAM,
Director Lynn & Boston Railroad Co.,
Boston, Mass.

*Third Vice-President:*
RUSSELL B. HARRISON,
President Terre Haute Street Railway Co., Terre Haute, Ind.

*Secretary and Treasurer:*
* WILLIAM J. RICHARDSON,
Director Atlantic Avenue Railroad Co.,
Brooklyn, N. Y.

EXECUTIVE COMMITTEE:
President, Vice-Presidents and
*Henry C. Payne, Vice-President Milwaukee Street Railway Co..Milwaukee, Wis.
*William H. Jackson, President Nashville Street Railway.......Nashville, Tenn.
D. G. Hamilton, President Cass Ave. & Fair Grounds Ry. Co. and St. Louis R. R. Co.............................................St. Louis, Mo.
Granville C. Cunningham, Man. Montreal Street Railway Co..Montreal Quebec.
John N. Partridge, Pres. Brooklyn City & Newtown Railroad Co.Brooklyn, N. Y.
Elected at Atlanta, Ga., October 19, 1894.

## OFFICERS, 1895-1896.

*President:*
H. M. LITTELL,
President Atlantic Avenue Railroad Co., Brooklyn, N. Y.

*First Vice-President:*
GRANVILLE C. CUNNINGHAM,
Manager Montreal Street Railway Co.,
Montreal, Quebec.

*Second Vice-President:*
*WILLIAM H. JACKSON,
President Nashville Street Railway,
Nashville, Tenn.

*Third Vice-President:*
J. WILLARD MORGAN,
President Camden, Gloucester & Woodbury Railroad Co., Camden, N. J.

*Secretary and Treasurer:*
T. C. PENINGTON,
Treasurer Chicago City Railway Co.,
Chicago, Ill.

EXECUTIVE COMMITTEE:
President, Vice-Presidents and
Joel Hurt, President Atlanta Consolidated Street Railway Co........Atlanta, Ga.
Prentiss Cummings, Vice-President West End Street Railway Co..Boston, Mass.
C. G. Goodrich, Vice-President Twin City Railway Co..........St. Paul, Minn.
A. Markle, General Manager, Lehigh Traction Co................Hazleton, Pa.
W. F. Kelly, General Manager Columbus Street Railway Co........Columbus, O.
Elected at Montreal, Quebec, October 18, 1895.

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*Deceased.

## OFFICERS, 1896-1897.

*President:*

ROBERT McCULLOCH,

Vice-President and General Manager Citizens' Cass Avenue & St. Louis Railroad Cos., St. Louis, Mo.

*First Vice-President:*
CHARLES S. SERGEANT,
General Manager West End Street Railway Co., Boston, Mass.

*Second Vice-President:*
D. B. DYER,
President Augusta Railway & Electric Co., Augusta, Ga.

*Third Vice-President:*
C. F. HOLMES,
General Manager Metropolitan Street Railway Co., Kansas City, Mo.

*Secretary and Treasurer:*
T. C. PENINGTON,
Treasurer Chicago City Railway Co., Chicago, Ill.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and
H. M. Littell, Vice-Pres. and Gen. Man. Metropolitan St. Ry. Co..New York City.
H. P. Bradford, Gen. Man. Cincinnati Inclined Plane Railway Co..Cincinnati, O.
Charles H. Smith, General Superintendent Troy City Railway Co....Troy, N. Y.
Harry Scullin, Vice-Pres. and Gen. Man. Union Depot Railroad Co., St. Louis, Mo.
George B. Hippee, Gen. Man. Des Moines City Railway Co..Des Moines, Iowa.
Elected at St. Louis, Mo., October 23, 1896.

## OFFICERS, 1897-1898.

*President:*

ALBION E. LANG,

President Toledo Traction Co., Toledo, Ohio.

*First Vice-President:*
W. CARYL ELY,
President Buffalo & Niagara Falls Electric Railway Co., Niagara Falls, N. Y.

*Second Vice-President:*
JOHN A. RIGG,
President United Traction Co., Reading, Pa.

*Third Vice-President:*
EDWARD G. CONNETTE,
General Manager Nashville Street Railway, Nashville, Tenn.

*Secretary and Treasurer:*
T. C. PENINGTON,
Treasurer Chicago City Railway Co., Chicago, Ill.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and
Robert McCulloch, Vice-President and General Manager Citizens' Cass Ave. & St. Louis R. R. Cos....................................St. Louis, Mo.
*C. Densmore Wyman, Gen. Man. New Orleans Traction Co., Ltd.New Orleans, La.
Henry C. Moore, President Trenton Street Railway Co..........Trenton, N. J.
John M. Roach, Vice-President and General Manager North Chicago Street Railroad Co. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .Chicago, Ill.
Robert S. Goff, Pres. and Gen. Man. Globe Street Railway Co..Fall River, Mass.
Elected at Niagara Falls, October 22, 1897.

## OFFICERS, 1898-1899.

*President:*

CHARLES S. SERGEANT,

Second Vice-President Boston Elevated Railway Co., Boston, Mass.

*First Vice-President:*
HENRY C. MOORE,
President Trenton Street Railway Co., Trenton, N. J.

*Second Vice-President:*
ERNEST WOODRUFF,
President Atlanta Consolidated Street Railway Co., Atlanta, Ga.

*Third Vice-President:*
WALTON H. HOLMES,
Vice-President and General Manager, Metropolitan Street Railway Co., Kansas City, Mo.

*Secretary and Treasurer:*
T. C. PENINGTON,
Treasurer Chicago City Railway Co., Chicago, Ill.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and
Albion E. Lang, President Toledo Traction Co....................Toledo, Ohio.
George A. Yuille, Second Vice-Pres. West Chicago Street Railroad Co.Chicago, Ill.
Frank G. Jones, Vice-President Memphis Street Railway Co.....Memphis, Tenn.
John I. Beggs, Gen. Man. The Milwaukee Electric R'y and Lt. Co.Milwaukee, Wsi.
Ira A. McCormack, Gen. Supt. Brooklyn Heights Railroad Co..New York, N. Y.
Elected at Boston, Mass., September 9, 1898.

## OFFICERS, 1899-1900.

*President:*
JOHN M. ROACH,
President Chicago Union Traction Co., Chicago, Ill.

*First Vice-President:*
JOHN A. RIGG,
President United Traction Co., Reading, Pa.

*Second Vice-President:*
HERBERT H. VREELAND,
President Metropolitan Street Railway Co., New York, N. Y.

*Third Vice-President:*
FRANK G. JONES,
Vice-President Memphis Street Railway Co., Memphis, Tenn.

*Secretary and Treasurer:*
T. C. PENINGTON,
Treasurer Chicago City Railway Co., Chicago, Ill.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and
Charles S. Sergeant, Second Vice-President Boston Elevated Ry. Co. Boston, Mass.
Charles K. Durbin, General Superintendent Denver City Tramway Co. Denver, Col.
Nicholas S. Hill, Jr., Gen. Mgr., Charleston Consolidated Gas & Elec. Co., Charleston, S. C.
Charles W. Wason, Pres. Cleveland, Painesville & Eastern Ry. Co. . Cleveland, O.
John R. Graham, President Quincy & Boston Street Ry. Co.......Quincy, Mass.
Elected at Chicago, Ill., October 20, 1899.

## OFFICERS, 1900-1901.

*President:*
WALTON H. HOLMES,
President Metropolitan Street Railway Co., Kansas City, Mo.

*First Vice-President:*
HERBERT H. VREELAND,
President Metropolitan Street Railway Co., New York, N. Y.

*Second Vice-President:*
N. H. HEFT,
President Meriden Electric Railroad Co., Meriden, Conn.

*Third Vice-President:*
JOHN B. McCLARY,
General Manager Birmingham Railway, Light & Power Co., Birmingham, Ala.

*Secretary and Treasurer:*
T. C. PENINGTON,
Treasurer Chicago City Railway Co., Chicago, Ill.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and
John M. Roach, President Chicago Union Traction Co..............Chicago, Ill.
Frank L. Fuller, Gen. Mgr. Wilkes-Barre & Wyoming Valley Traction Co., Wilkes-Barre, Pa.
George W. Baumhoff, General Manager St. Louis Transit Co....St. Louis, Mo.
John R. Graham, President Brockton Street Railway Co.........Brockton, Mass.
John Harris, Superintendent Cincinnati Street Railway Co........Cincinnati, O.
Elected at Kansas City, October 19, 1900.

## OFFICERS, 1901-1902.

*President:*
HERBERT H. VREELAND,
President Metropolitan Street Railway Co., New York, N. Y.

*First Vice-President:*
CHAS. W. WASON,
President Cleveland, Painsville & Eastern Railroad Co., Cleveland, O.

*Second Vice-President:*
ELWIN C. FOSTER,
Vice-President Boston & Northern Street Railway Co., Boston, Mass.

*Third Vice-President:*
H. M. SLOAN,
General Manager Calumet Electric Street Railway Co., Chicago, Ill.

*Secretary and Treasurer:*
T. C. PENINGTON,
Treasurer Chicago City Railway Co., Chicago, Ill.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and
Walton H. Holmes, President Metropolitan Street Railway Co. . Kansas City, Mo.
John A. Rigg, President United Traction Co.......................Reading, Pa.
Daniel B. Dyer, President Augusta Railway & Electric Co.........Augusta, Ga.
T. J. Nicholl, Vice-President Rochester Railway Co...........Rochester, N. Y.
George W. Dickinson, Vice-President Seattle Electric Co..........Seattle, Wash.
Elected at New York, N. Y., October 11, 1901.

## OFFICERS, 1902-1903.

*President:*
JERE C. HUTCHINS,
President Detroit United Railway, Detroit, Mich.

*First Vice-President:*
W. CARYL ELY,
President International Railway Co., Buffalo, N. Y.

*Second Vice-President:*
W. KESLEY SCHOEFF,
President Cincinnati Traction Co., Cincinnati, O.

*Third Vice-President:*
P. S. ARKWRIGHT,
President Georgia Railway & Electric Co., Atlanta, Ga.

*Secretary and Treasurer:*
T. C. PENINGTON,
Treasurer Chicago City Railway Co., Chicago, Ill.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and
Herbert H. Vreeland, President Metropolitan Street Railway Co., New York, N. Y.
Richard T. Laffin, Gen. Mgr. Worcester Consolidated St. Ry. Co., Worcester, Mass.
Andrew Radel, Vice-Pres. Middlesex & Somerset Traction Co..Bridgeport, Conn.
Walter P. Read, Vice-Pres. Consolidated Ry. & Power Co.. Salt Lake City, Utah.
Willard J. Hield, Gen. Man. Twin City Rapid Transit Co.....Minneapolis, Minn.
Elected at Detroit, Mich., October 10, 1902.

## OFFICERS, 1903-1904.

*President:*
HON. W. CARYL ELY,
President International Railway Co., Buffalo, N. Y.

*First Vice-President:*
ELWIN C. FOSTER,
President New Orleans Railways Co., New Orleans, La.

*Second Vice-President:*
JOHN GRANT,
General Superintendent St. Louis Transit Co., St. Louis, Mo.

*Third Vice-President:*
JAMES F. SHAW,
General Manager Boston & Worcester Street Railway Co., Boston, Mass.

*Secretary and Treasurer:*
T. C. PENINGTON,
Treasurer Chicago City Railway Co., Chicago, Ill.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and
Jere C. Hutchins, President Detroit United Railway..............Detroit, Mich.
Addison B. Colvin, President Hudson Valley Railway Co......Glens Falls, N. Y.
G. Tracy Rogers, President Binghamton Railway Co..........Binghamton, N. Y.
W. A. Smith, General Manager Omaha & Council Bluffs Ry. Co....Omaha, Neb.
S. L. Nelson, General Manager Wichita Railway & Light Co.......Wichita, Kan.
Elected at Saratoga Springs, N. Y., September 4, 1903.

## OFFICERS, 1904-1905.

*President:*
HON. W. CARYL ELY,
President International Railway Co., Buffalo, N. Y.

*First Vice-President:*
ELWIN C. FOSTER,
President New Orleans Railways Co., New Orleans, La.

*Second Vice-President:*
JOHN I. BEGGS,
President, The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

*Third Vice-President:*
RICHARD McCULLOCH,
Assistant General Manager United Railways Co. of St. Louis, St. Louis, Mo.

*Secretary and Treasurer:*
T. C. PENINGTON,
Treasurer Chicago City Railway Co., Chicago, Ill.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and
John J. Stanley, General Manager Cleveland Electric Railway Co.Cleveland, Ohio
Howard F. Grant, Manager Seattle Electric Co..................Seattle, Wash.
Calvin G. Goodrich, Vice-Pres. Twin City Rapid Transit Co..Minneapolis, Minn.
Frank G. Jones, Vice-President Memphis Street Railway Co......Memphis, Tenn.
Walter E. Harrington, General Superintendent South Jersey Division, Public Service Corporation of New Jersey.......................Camden, N. J.
Elected at St. Louis, Mo., October 13, 1904.

# OFFICERS, 1905-1906.

## (American Street and Interurban Railway Association.)

*President:*
HON. W. CARYL ELY,
President Ohio Valley Finance Co., Buffalo, N. Y.

*First Vice-President:*
JOHN I. BEGGS,
President The Milwaukee Electric Railway and Light Co., and United Railways of St. Louis, Milwaukee, Wis.

*Second Vice-President:*
CALVIN G. GOODRICH,
Vice-President Twin City Rapid Transit Co., Minneapolis, Minn.

*Third Vice-President:*
JAMES F. SHAW,
President Boston & Worcester Electric Co.'s, Boston, Mass.

*Secretary and Treasurer:*
BERNARD V. SWENSON,
60 Wall Street, New York, N. Y.

EXECUTIVE COMMITTEE:

President, Vice-Presidents and
W. B. Brockway, Auditor Nashville (Tenn.) Railway & Light Co.; President, American Street & Interurban Railway Accountants' Assn.....Yonkers, N. Y.
H. H. Adams, Superintendent of Shops The United Railways & Electric Co.; President American Street Interurban Railway Eng. Assn......Baltimore, Md.
S. L. Rhoades, General Claim Agent Philadelphia Rapid Transit Co.; President, American Street & Interurban Railway Claim Agents' Assn...Philadelphia, Pa.
Elected at Philadelphia, Pa., September 28, 1905.

# CONVENTION PROGRAM.

(Atlantic City, New Jersey, October 14, 15 and 16, 1907.)

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### *Wednesday*—9 30 A M to 1 00 P M

Convention Called to Order.
Address of Welcome — By the Hon. F. P. Stoy, Mayor of Atlantic City.
President's Address.
Report of Executive Committee.
Report of Secretary and Treasurer.
Addresses by Presidents of Affiliated and Allied Associations.
Announcements.
New Business.
Reports of Committees.
  (a) Membership.
  (b) Compensation for Carrying U. S. Mail.
  (c) Subjects.
  (d) Car Wiring.
  (e) Standardization of Equipment.
Paper —"The Technically Trained Man and the Electric Railway Profession," by Prof. H. H. Norris, Cornell University, Ithaca, N. Y.
Paper —"The National Fire Protection Association," by Ralph Sweetland, Boston, Mass.
Paper —"The Influence of the Design of Railway Structures on Economy of Operation," by H. T. Campion and William McClellan, New York, N. Y.

### *Thursday*—9 30 A M to 1 00 P M

Appointment of Nominating Committee.
Reports of Committees.
  (a) Promotion of Traffic.
  (b) Rules for the Government of Motormen and Conductors.
  (c) Heavy Electric Traction.
Paper —"Light Freight Handling by Electric Lines," by P. P. Crafts, General Manager, Iowa & Illinois Railway Co., Clinton, Iowa; General Manager, Joplin & Pittsburg Railway Co., Pittsburg, Kan.
Paper —"Freight Service on Electric Railroads," by H. H. Polk, President, Inter-Urban Railway Co., Des Moines, Iowa.
Paper —"A Department of Publicity," by J. Harvey White, Publicity Manager, Boston Elevated Railway Co., Boston, Mass.

*Convention Program* — (Continued).

Paper — "Advertising from the Standpoint of the Street Railway Company," by A. W. Warnock, General Passenger Agent, Twin City Rapid Transit Co., Minneapolis and St. Paul, Minn.

Paper — "Problems of the Small Electric Road," by H. S. Cooper, Manager, Galveston Electric Co., Galveston, Texas.

Paper — "The Use of the 'Tee' Rail in Cities," by C. Gordon Reel, Vice-President, Kingston Consolidated Railway Co., Kingston, N. Y.

### *Friday* — 9 30 A M to 1 00 P M

Reports of Committees.
- (a) Insurance.
- (b) Rules for the Construction of Modern Car Houses.
- (c) Municipal Ownership.
- (d) Public Relations.

Paper — "Interurban Railway Fares," by Theodore Stebbins, New York, N. Y.

Paper — "Municipal Ownership in Great Britain and in the United States," by William J. Clark, New York, N. Y.

Report of Nominating Committee.

Election of Officers.

Resolutions.

Unfinished Business.

Adjournment.

# REGISTRATION AT THE ATLANTIC CITY CONVENTION.

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Editor's Note:—This is the complete registration as taken at the booth of the association. It does not include the registration taken by the Manufacturers' Association. In general, the delegates attended those conventions in which they were professionally interested. In the proceedings of the affiliated associations will be found lists showing those who were registered as delegates and guests of these various associations.

## PAST PRESIDENTS OF THE ASSOCIATION.

Lang, Albion E., Director, Toledo Railways & Light Co., Toledo, O.
Sergeant, C. S., Vice-President, Boston Elevated Railway Co., Boston, Mass.
Ely, Hon. W. Caryl, President, Ohio Valley Finance Co., Buffalo, N. Y.

## DELEGATES OF MEMBER COMPANIES.

(*Indicates that the individual named is also an associate member.)

Albany & Hudson Railroad Co.:
  Leavitt, R. P., General Mechanical and Electrical Superintendent.
Altoona & Logan Valley Electric Railway Co.:
  Crane, S. S., General Manager,
  Hare, S. P., Claim Agent,
  Mulholland, W. J., Purchasing Agent.
Atlantic Coast Electic Railway Co.:
  Hazelrigg, S. F., President,
  Cade, G. B., Secretary and Auditor,
  Hereth, C. E., Superintendent.
Aurora, Elgin & Chicago Railroad Co.:
  Faber, Edwin C., General Manager,
  Gould, E. F., Electrical Engineer.
Bangor Railway & Electric Co.:
  Graham, John R., President and General Manager,
  Silliman, Frank, Jr., Vice-President,
  Snow, W. H., Superintendent Railway Department,
  McCormick, Morris, Master Mechanic.
Beaumont Traction Co.:
  Duffy, F. J., Manager.

*Delegates of Member Companies* — (Continued).

BIRMINGHAM RAILWAY, LIGHT & POWER CO.:
*White, E. M., Treasurer and Auditor,
Root, L. Carroll, Special Auditor,
Doerr, C. T., Purchasing Agent.

BOSTON & MAINE RAILROAD CO.:
*Hall, F. D., Chief Electrician,
Fosgate, F. P., Assistant Superintendent.

BOSTON & NORTHERN STREET RAILWAY CO.:
Bartlett, D. Dana, General Auditor,
Conway, J. T., Superintendent,
Lees, Thomas, Superintendent,
Seibel, G. S., Superintendent,
Wilkinson, F. C., Superintendent,
Palmer, G. W., Jr., Electrical Engineer,
Holst, E. W., Superintendent of Equipment,
Welsh, P. S.

BOSTON & WORCESTER STREET RAILWAY CO.:
*Shaw, J. F., President,
Shaw, E. P., Jr., General Superintendent,
Ayres, M. V., Electrical Engineer,
Wadsworth, W. H., Master Mechanic,
McFee, G. H., Chief Dispatcher.

BOSTON ELEVATED RAILWAY CO.:
Sergeant, C. S., Vice-President,
*Corning, J. W., Electrical Engineer,
Sears, Russell A., General Attorney,
Leary, W. J., Inspector Rolling Stock,
Scott, P., Inspector Rolling Stock,
Noble, H. G., Assistant Superintendent,
Benjamin, G. H., Train Master,
Mahler, Edward, Purchasing Agent,
Spillane, M. P., Claim Agent.

BRIDGETON & MILLVILLE TRACTION CO.:
Hires, B. F., General Manager,
Shepherd, J. L., Superintendent,
Sooy, A. H., Cashier,
Sharp, A. M., Master Mechanic,
Duffield, C. F., Engineer,
Way, A. P., Engineer,
Meyers, W. H.

BROCKTON & PLYMOUTH STREET RAILWAY CO.:
Warren, A. H., Manager,
Smith, H. C., Chief Clerk.

*Delegates of Member Companies* — (Continued).

BUFFALO & LAKE ERIE TRACTION CO.:
- Mayer, J. B., President,
- Harrigan, J. R., Assistant General Manager,
- Mayer, L.

CALUMET ELECTRIC STREET RAILWAY CO.:
- Sloan, H. M., General Manager.

CAMDEN INTERSTATE RAILWAY CO.:
- Magoon, W. W., General Manager,
- Fagan, James, Purchasing Agent.

CAPITAL TRACTION CO.:
- Crampton, H. D., Secretary,
- Simms, R. D., Treasurer,
- Carll, D. S., Superintendent,
- *Harper, J. W., Master Mechanic,
- *Morrill, Flavius, Roadmaster,
- Dunlop, G. Thomas, Assistant Attorney.

CENTRAL PENNSYLVANIA TRACTION CO.:
- Musser, F. B., President,
- O'Connell, John, Purchasing Agent,
- Rexroth, A. F., Master Mechanic,
- Gerhart, P. F., Electrician,
- Pratt, M. B.

CHARLESTON CONSOLIDATED RAILWAY, GAS & ELECTRIC CO.:
- Balaguer, P. J., Auditor,
- Passailaigue, T. W., Superintendent of Railways.

CHARLOTTE ELECTRIC RAILWAY, LIGHT & POWER CO.:
- *Latta, E. D., Jr., General Manager.

CHICAGO & JOLIET ELECTRIC RAILWAY CO.:
- Kibbe, A. S., Chief Engineer,
- Huen, W. H., Superintendent of Transportation,
- Martin, James.

CHICAGO & MILWAUKEE ELECTRIC RAILROAD CO.:
- Stearns, R. B., General Manager,
- Ives, R. S., Superintendent,
- Smith, L. L., Master Mechanic.

CHICAGO UNION TRACTION CO.:
- Smith, F. E., Auditor,
- Bradley, H. C., Claim Agent.

CHILLICOTHE ELECTRIC RAILROAD, LIGHT & POWER CO.:
- Moser, A. G., General Manager.

CINCINNATI TRACTION CO.:
- MacAlister, W. H., Comptroller,
- Glover, H. W., Auditor.

CITIZENS ELECTRIC STREET RAILWAY CO.:
- Butman, G. A., Treasurer,
- Files, O. F., Superintendent.

*Delegates of Member Companies* — (Continued).

CLEVELAND ELECTRIC RAILWAY CO.:
Davies, H. J., Secretary,
McDole, W. G., Auditor,
Weh, W. F., Claim Agent,
Radcliffe, G. S., General Superintendent,
Duty, A. E., Assistant General Sunperintendent,
Staats, H. N., Insurance Department,
Tilton, B. E., Engineer Maintenance of Way,
Scullin, T., Master Mechanic,
Rifenberick, R. B., Consulting Engineer,
Veal, Samuel,
Zimmer, H. H.

CLEVELAND, PAINESVILLE & EASTERN RAILROAD CO.:
Jordan, J., General Manager,
Schmock, E. L., Assistant Secretary and Auditor.

CLEVELAND, SOUTHWESTERN & COLUMBUS RAILWAY CO.:
Rutherford, J. A., Director,
Cavanaugh, H. B., Auditor.

COLOCADO SPRINGS & INTERURBAN RAILWAY CO.:
Rice, D. H., President,
Lathrop, B. M., Superintendent.

COLUMBUS RAILROAD CO.:
Wilbur, A. A., Assistant Treasurer.

COLUMBUS RAILWAY & LIGHT CO.:
Burington, P. V., Secretary and Auditor,
White, L. G., General Superintendent,
Ackerman, E. O., Engineer Maintenance of Way,
Davis, B. B., Claim Adjuster.

CONNECTICUT COMPANY, THE:
Townley, Calvert, Vice-President,
Lee, R. P., Superintendent,
Risley, L. S., Superintendent,
Ryden, E. W. T., Engineer,
Harte, C. R., Consulting Engineer,
Blanchard, A., Superintendent of Shops,
Symonds, C. S., Master Mechanic,
Cram, R. C., Assistant Engineer,
Benze, H. A.

CONCORD, MAYNARD & HUDSON STREET RAILWAY CO.:
Ogden, John W., Assistant Treasurer,
Ogden, L. M., Cashier and Bookkeeper,
Persons, Fred. A., Assistant Electrician,
Ogden, F. S., Master Mechanic,
Hammond, H. N., Track Master.

DALLAS CONSOLIDATED ELECTRIC STREET RAILWAY CO.:
Thomas, P. P., Assistant Treasurer,

*Delegates of Member Companies* — (Continued).

Bowers, L. A., Auditor,
Berry, D. W., District Master Mechanic.

DANBURY & BETHEL STREET RAILWAY CO.:
Griffing, M. H., Treasurer,
Tweedy, G. R., Passenger Agent.

DAYTON & ELECTRIC RAILWAY CO.:
Paxton, C. M., General Manager,
Crume, R. A., General Auditor.

DAYTON & XENIA TRANSIT CO.:
Ferneding, T. A., Superintendent.

DE KALB-SYCAMORE & INTERURBAN TRACTION CO.:
McMichael, J. G., President,
Thomson, D., General Manager,
Thomson, I. N.

DENVER CITY TRAMWAY CO.:
Matthews, W. G., Superintendent,
Dorsey, S. C., Claim Agent.

DES MOINES CITY RAILWAY CO.:
Hippee, G. M., Vice-President,
Hippee, G. B., Treasurer and Manager,
Maish, A. G., Secretary,
Welsh, J. E., Master Mechanic.

DETROIT UNITED RAILWAY:
Fullerton, Irwin, General Auditor,
Bullen, Harry, General Superintendent,
Edwards, Allen F., Purchasing Agent,
Parker, G. W., General Express and Freight Agent.

DULUTH STREET RAILWAY CO.:
Warren, Herbert, General Manager,
Wood, T. S., Claim Agent.

EAST LIVERPOOL TRACTION & LIGHT CO.:
W. Caryl Ely, Director,
McDonnell, Edward, Secretary and Treasurer,
Rothery, J. C., General Manager,
Kidder, W. H.

EASTERN WISCONSIN RAILWAY & LIGHT CO.:
Draper, N. C., Vice-President and General Manager,
Kelsh, W. J., Superintendent.

EASTON TRANSIT CO.:
Fehr, H. R., President,
Maltby, E. B., Auditor,
Jenkins, C. E., Engineer Maintenance of Way,
Roberts, C. F., Master Mechanic.

EAST ST. LOUIS & SUBURBAN RAILWAY CO.:
Gregory, T. W., Assistant Treasurer,
Pierce, G. C., General Superintendent,
Merker, H. F., Acting Engineer Maintenance of Way.

*Delegates of Member Companies* — (Continued).

ELGIN & BELVIDERE ELECTRIC CO.:
  Arnold, B. J., Director,
  Arnold, W. L., General Manager,
  Weston, George, Chief Engineer.

ELMIRA WATER, LIGHT, HEAT & RAILROAD CO.:
  Maloney, F. G., Superintendent,
  Post, C. L., Purchasing Agent.

EL PASO ELECTRIC RAILWAY CO.:
  Silsbee, H. K., Assistant Treasurer.

ENID CITY RAILWAY CO.:
  Bosler, C. H., President,
  Dwyer, Dennis, Vice-President,
  Manuel, E., Counsel.

ERIE TRACTION CO.:
  Hatch, C. M., General Manager.

EVANSVILLE & EASTERN ELECTRIC RAILWAY:
  Battin, C. H., General Manager.

FAIRMONT & CLARKSBURG TRACTION CO.:
  Miller, Walton, Secretary and Treasurer,
  Watson, Geo. T., General Manager,
  Purinton, A. J., Consulting Engineer.

FITCHBURG & LEOMINSTER STREET RAILWAY CO.:
  Wallis, R. N., Treasurer,
  Sargent, W. W., Superintendent,
  Bennett, H. K., Claim Agent,
  Britt, L. T., Foreman.

FONDA, JOHNSTOWN & GLOVERSVILLE RAILROAD CO.:
  Collins, W. H., General Superintendent,
  Harris, G. A., General Auditor,
  Bagg, F. A., Chief Engineer.

FORD, BACON & DAVIS COMPANIES:
  Brockway, W. B., General Auditor,
  Sawyer, W. H., Engineer.

FORT WAYNE & SPRINGFIELD RAILWAY CO.:
  Fledderjohann, W. H., General Manager,
  Shelton, T. W., General Superintendent.

FORT WAYNE & WABASH VALLEY TRACTION CO.:
  Emmons, C. D., General Manager,
  Crawford, J. B., Superintendent of Transportation,
  Vordermark, H. E., Auditor,
  Johnson, Benjamin.

GALVESTON ELECTRIC CO.:
  Randall, F. C., Assistant to Manager,
  Drouilhet, A., Assistant Treasurer,
  Parker, Lee H.

*Delegates of Member Companies* — (Continued).

GARDINER, WESTMINSTER & FITCHBURG STREET RAILROAD CO.:
- Dane, W. R., Treasurer,
- Jefts, C. A., Superintendent.

GEORGIA RAILWAY & ELECTRIC CO.:
- Hurt, H. N., Superintendent,
- Simmons, S. E., Assistant Superintendent of Transportation,
- Redding, S. A., Electrical Engineer,
- Glenn, W. H., Superintendent Maintenance of Way,
- Moore, A. M., Master Mechanic,
- Graves, G. B., Purchasing Agent,
- Mathews, C. H., Claim Agent,
- Glenn, S. C., Inspector of Trausportation.

GRAND RAPIDS RAILWAY CO.:
- Clark, C. M., President,
- Madigan, J. C., Superintendent,
- Livingston, W. E., Audit Clerk,
- Roderick, T. C., Assistant Superintendent,
- Lynch, Daniel, General Shop Foreman.

GROTON & STONINGTON STREET RAILWAY CO.:
- Ryley, T. W., Superintendent,
- Noyes, Ira C.

HOUGHTON COUNTY STREET RAILWAY CO.:
- Du Fresne, J. H., Assistant Treasurer,
- Richardson, G. A., Superintendent.

HOUSTON ELECTRIC CO.:
- Harding, H. L., Assistant Treasurer.

ILLINOIS CENTRAL TRACTION CO.:
- Mattis, Geo. M., Assistant Treasurer,
- Hoagland, H. C., Chief Engineer,
- Harry, M. L., General Superintendent,
- Linn, M G., General Superintendent.

INDIANAPOLIS & CINCINNATI TRACTION CO.:
- Henry, C. L., President and General Manager,
- Frazee, W. M., Claim Adjuster,
- Frazer, William.

INDIANAPOLIS TRACTION & TERMINAL CO.:
- McGowan, H. J., President,
- Todd, R. I., Vice-President and General Manager,
- Mahoney, J. J., Superintendent.

INDIANA, COLUMBUS & EASTERN TRACTION CO.:
- Adams, J. L., General Manager Western Division,
- Benham, A., General Inspector.

INDIANA UNION TRACTION CO.:
- Brady, Arthur W., President,
- Nicholl, H. A., General Manager,
- Forse, W. H., Jr., Secretary and Treasurer,

*Delegates of Member Companies* — (Continued).

Sparks, W. C., Superintendent of Roadway,
Taylor, R. C., Superintendent of Motive Power,
Carpenter, E. C., Claim Agent.

INTERNATIONAL RAILWAY CO.:
Wilson, T. W., General Manager,
Slocum, J. F., Secretary and Treasurer,
Harvey, G. A., Electrical Engineer,
*Evans, W. H., Master Mechanic,
Clark, C. H., Engineer of Way,
Mack, H. L., Superintendent of Electric Lines,
Farrell, A. J., Claim Agent,
Garrett, E., Assistant Superintendent,
Henning, E. S., Assistant Superintendent,
Kinsella, W. J., Assistant Superintendent,
Chambers, George, General Agent,
Evans, W. C.

INTER-URBAN RAILWAY CO.:
Polk, H. H., President and General Manager,
Wight, C. L., General Auditor,
Cummins, F. S., General Superintendent and Chief Engineer.

IOWA & ILLINOIS RAILWAY CO.:
Crafts, P. P., General Manager.

JACKSON CONSOLIDATED TRACTION CO.:
O'Mara, B. F., General Superintendent,
Bennett, C. E., Master Mechanic.

JACKSONVILLE ELECTRIC CO.:
Tucker, W. H., Assistant Treasurer,
Morse, H. H., Superintendent of Transportation,
Harrison, J. S., Claim Agent.

JOLIET & SOUTHERN TRACTION CO.:
Fisher, L. D., Treasurer and Chief Engineer.

JOPLIN & PITTSBURG RAILWAY CO.:
Prescott, John, Secretary and Treasurer,
Lloyd, H. A.

KINGSTON CONSOLIDATED RAILROAD CO.:
Reel, C. G., Vice-President and General Manager,
te Bow, G. B., Superintendent.

KNOXVILLE RAILWAY & LIGHT CO.:
Bunn, H. T., Treasurer and Auditor,
*Mitchel, P. E., General Superintendent,
Kelly, T. C., Superintendent,
Flood, J. F., Engineer,
Roberts, Judge E. R., Assistant Attorney.

LAKE SHORE ELECTRIC RAILWAY CO.:
Coen, F. W., Secretary and Treasurer,
Rimelspach, H. G., Claim Agent.

*Delegates of Member Companies* — (Continued).

LEHIGH VALLEY TRANSIT CO.:
- Stevens, R. P., President,
- Hall, W. S., General Manager,
- Walter, C. M., Auditor,
- Easty, C. B., Master Mechanic,
- *Yount, J. M., Engineer,
- Schoenen, R. H., Claim Agent,
- Luckenbach, John.

LEXINGTON RAILWAY CO.:
- MacLeod, George, Chief Engineer,
- McClaren, G., Engineer.

LITTLE ROCK RAILWAY & ELECTRIC CO.:
- Hegarty, D. A., Treasurer and General Manager,
- Tharp, W. J., Auditor,
- Griffith, C. J., Superintendent of Railway,
- Tunnah, W. J., Master Mechanic.

LONG ISLAND CONSOLIDATED ELECTRICAL COS.:
- Bierck, A. B., Auditor,
- Hodges, H. B., Purchasing Agent.

LOUISVILLE & SOUTHERN INDIANA TRACTION CO.:
- Cole, F. E., General Superintendent,
- Scott, C. B., Claim Agent.

LYNCHBURG TRACTION & LIGHT CO.:
- Apperson, R. D., President,
- Frost, D. C., Superintendent,
- Powell, A. T., Cashier.

MAHONING & SHENANGO RAILWAY & LIGHT CO.:
- Rogers, S. C., Treasurer and Auditor,
- Thompson, S. B., Master Mechanic,
- Lee, Thomas J., Roadmaster.

MANILA ELECTRIC RAILROAD & LIGHT CO.:
- Wickham, T. F., Secretary and Treasurer,
- Pardee, J. H., Operating Manager,
- Young, C. S., Construction Manager.

MEMPHIS STREET RAILWAY CO.:
- Tutwiler, T. H., President and General Manager,
- McWhorter, A. D., Master Mechanic,
- Proctor, C. B., Claim Agent.

MICHIGAN UNITED RAILWAYS CO.:
- Kries, J. A., Jr., Chief Engineer,
- Bushong, A. T., Engineer Maintenance of Way,
- Hobin, M. J., Claim Agent.

MILFORD & UXBRIDGE STREET RAILWAY CO.:
- Adams, W. L., Superintendent.

MILLVILLE TRACTION CO.:
- Thomas, G. H., Secretary,
- Straub, J. E., Master Mechanic.

*Delegates of Member Companies* — (Continued).

MILWAUKEE ELECTRIC RAILWAY & LIGHT CO., THE:
- Beggs, J. I., President,
- Wetmore, C. W., Vice-President,
- Duffy, C. N., Comptroller,
- *Simmons, F. G., Superintendent of Construction and Maintenance of Way,
- *Olds, E. W., Master Mechanic and Superintendent of Rolling Stock,
- Rausch, M. E., Claim Agent,
- Lemon, Dr. C. H., Surgeon,
- Mullett, H. A., Superintendent of Rolling Stock,
- Ellis, A. K., Superintendent,
- Atkin, J. H.

MOBILE LIGHT & RAILROAD CO.:
- Wilson, J. H., President and Manager,
- Coffin, S. M., Master Mechanic.

MONTREAL STREET RAILWAY CO.:
- McDonald, Duncan, Manager,
- Smith, H. E., Comptroller,
- Casey, T. W., Purchasing Agent,
- Gaboury, A., Superintendent,
- Casey, T. F.

NAHANT & LYNN STREET RAILWAY CO.:
- Dozier, J. E., General Manager.

NASHVILLE RAILWAY & LIGHT CO.:
- Warner, Percy, President,
- Walters, H. C., Secretary and Treasurer,
- Davis, H. A., Superintendent,
- Swint, George, Master Mechanic,
- Harmon, Kinney, Claim Agent,
- Jackson, R. F., Attorney.

NEW HAMPSHIRE ELECTRIC RAILWAYS:
- Belden, D. A., President,
- Woodman, Franklin, General Manager.

NEW ORLEANS RAILWAY & LIGHT CO.:
- Ferrandou, H. A., Treasurer and Auditor.

NEWPORT NEWS & OLD POINT RAILWAY & ELECTRIC CO.:
- von Schilling, Franz, Auditor.

NEWTON & BOSTON STREET RAILWAY CO.:
- Brush, M. C., Vice-President and General Manager,
- Sylvester, C. A., Assistant General Manager.

NEW YORK & QUEENS COUNTY RAILWAY CO.:
- Banghart, C. H., Master Mechanic.

NEW YORK CITY RAILWAY CO.:
- Campbell, Peter, Superintendent,
- Wilder, C. W., Assistant Engineer,
- Coleman, E. J., Superintendent,

*Delegates of Member Companies* — (Continued).

NEW YORK CITY RAILWAY CO.— *Continued:*
  Nickel, P. C., Claim Agent,
  Wood, W. O., Statistician.
NORFOLK & PORTSMOUTH TRACTION CO.:
  Hathaway, E. C., General Manager,
  Gay, T. B., Secretary,
  Ely, E. S., Chief Engineer of Construction,
  *Longmire, E. A., Master Mechanic,
  Taylor, W. K., Attorney.
NORTHAMPTON TRACTION CO.:
  Hay, W. O., Secretary,
  Beaulieu, D. L., Superintendent,
  Richter, D. L. Master Mechanic,
  Brunner, C. B., Claim Agent.
NORTHERN OHIO TRACTION & LIGHT CO.:
  Currie, Charles, General Manager,
  Lahr, C. H., Auditor,
  Roberts, William, Superintendent,
  Inskeep, R. E.
NORTHERN TEXAS TRACTION CO.:
  Edgar, H. T., Vice-President and General Manager,
  Butwell, A. W., Assistant Treasurer.
OHIO RIVER ELECTRIC RAILWAY & POWER CO.:
  Walmsley, J. T., Treasurer.
OKLAHOMA CITY RAILWAY CO.:
  Classen, A. H., President.
OMAHA & COUNCIL BLUFFS STREET RAILWAY CO.:
  Smith, W. A., General Manager.
OMAHA, LINCOLN & BEATRICE STREET RAILWAY CO.:
  Smith, W. A.
OTTAWA ELECTRIC RAILWAY CO.:
  Fraser, J. D., Secretary and Treasurer,
  Hutcheson, J. E., Superintendent.
PADUCAH TRACTION CO.:
  Bigham, J. E., Assistant Treasurer.
PENSACOLA ELECTRIC CO.:
  Leadley, J. W., Manager,
  Carroll, R. G., Assistant Treasurer.
PEOPLES RAILWAY CO.:
  Towle, G. E., General Manager,
  Wuichet, Eugene, Assistant Secretary,
  Wilson, L. M., Master Mechanic.
PHILADELPHIA & WEST CHESTER TRACTION CO.:
  Taylor, A. M., President,
  Taylor, W. S., Vice-President,
  Aikens, H. H., Secretary,
  Fulton, C. B., Superintendent,
  Bennett, Dr. Francis, Surgeon.

*Delegates of Member Companies* — (Continued).

PHILADELPHIA RAPID TRANSIT CO.:
Kruger, C. O., Second Vice-President and General Manager,
Edds, G. H., Vice-President,
*Lincoln, F. H., Assistant General Manager,
Twining, W. S., Chief Engineer,
*Nichols, H. B., Engineer of Way,
*Taylor, G. B., Assistant Engineer,
*Heywood, James, Superintendent of Lines and Cables,
Hewitt, Charles, Superintendent of Motive Power,
Loughery, T. J., Superintendent of Shops,
Oliver, R. G., Master Mechanic,
Goshorn, H. R., General Claim Agent,
Johnson, F. W., Assistant General Claim Agent,
Gilmore, E. E., Assistant Superintendent of Lines and Cables.
Edds, G. H., Jr., Chief Clerk,
Manix, M., Engineer,
Shepard, R. K., Engineer,
Kerr, W. C., Assistant Engineer,
Ier, D. W., Engineering Department,
Branson, H., Shop Superintendent,
Janney, F. W., Division Superintendent,
Crocker, C. T., Chief Inspector,
McCoubrie, Robert, Chief Mechanical Inspector,
Markel, H., Inspector,
Shaughnessy, T. H., Inspector,
Nolan, John, Foreman Armature and Coil Department,
McDowd, H., Foreman,
Markel, J. L., Test Car Operator,
*Voynow, C. B., Engineer,
Maize, W. L., Purchasing Agent,
Lewis, J. B., Clerk, Transportation Department,
Kelly, Paul, General Storekeeper,
Neece, F. W., Claim Adjuster,
Rickert, Horace, Claim Adjuster,
Gherky, G. H.,
Nichols, H. H.,
Ellis, F. B.

PITTSBURG & BUTLER STREET RAILWAY CO.:
Gibson, Charles, Jr., Vice-President,
Wilcoxon, C. L., Superintendent,
*Layton, H. F., Chief Engineer,
Kidder, S. H.

PORTLAND RAILROAD CO.:
Prescott, C. H., Director,
Wheeler, W. A., Director,
Libby, C. F., President,
Newman, E. A., General Manager.

*Delegates of Member Companies* — (Continued).

PORTLAND RAILWAY CO.:
- Clark, H. L., Vice-President,
- Hopkins, M. S., Assistant to President.

POTTSVILLE UNION TRACTION CO.:
- Harrington, W. E., President,
- Lasher, F. B., Secretary and Treasurer.

POUGHKEEPSIE CITY & WAPPINGERS FALLS ELECTRIC RAILWAY CO.:
- Hinkley, J. W., Jr., President and General Manager.

PROVIDENCE & DANIELSON RAILWAY CO.:
- Sherman, D. F., President,
- *Thielsen, J. E., Superintendent.

PUBLIC SERVICE RAILWAY CO.:
- Danforth, R. E., General Manager,
- Young, P. S., Comptroller,
- Boylan, M. R., General Auditor,
- Stevenson, H. C., Assistant Secretary,
- Pearson, J. A., General Purchasing Agent,
- Bolen, N. W., Superintendent of Transportation,
- White, M., Superintendent of Way,
- *Schreiber, M., Engineer Maintenance of Way,
- Remelius, C., Superintendent of Rolling Equipment,
- Dunne, E. J., Superintendent of Overhead,
- Drown, H. V., General Claim Agent,
- Williams, E. L., Division Superintendent,
- Graham, W. B. Division Superintendent,
- Gettings, J. J., Division Superintendent,
- Bailey, F. A., Division Superintendent,
- Connors, P. J., Division Master Mechanic,
- Carroll, J. J., Division Master Mechanic,
- Adams, T. S., Division Master Mechanic,
- Hanf, John, Master Mechanic,
- Spencer, Paul, Consulting Engineer,
- Barker, George, Real Estate Agent,
- Dickson, A. E., Chief Clerk,
- Heilig, E. W., Chief Clerk,
- Stackpole, W. S., Clerk,
- McCourt, C. B., Assistant Chief Clerk,
- Pierson, P. W., Assistant Chief Clerk,
- Beatty, C. F., Superintendent of Track,
- Perrin, R. E., Claim Agent,
- Cushing, E. L., Claim Agent,
- Walsh, G. L., Claim Agent,
- Farwell, E. A., Claim Agent,
- Joyce, J. E., Claim Agent,
- Rudderrow, R. W., Claim Agent,
- Hughes, W. J., Traveling Auditor,
- **Barker, W. S., Assistant to the Comptroller,**

*Delegates of Member Companies* — (Continued).

PUBLIC SERVICE RAILWAY CO.—*Continued:*

- Bedwell, C. F., Engineer,
- Hine, E. W., Assistant to the President,
- Dunn, T. J., Line Foreman,
- McFeely, John, Assistant Engineer,
- Elliot, J. G., Superintendent,
- Knight, D. G., Superintendent of Buildings,
- Ramsey, W. J., Superintendent,
- Stone, George, Superintendent,
- Patterson, H. H., Assistant Superintendent,
- Burgbacher, F. F., Bookkeeper,
- Cash, J. E., Bookkeeper,
- Garland, H. J., Bookkeeper,
- Rapp, F., General Foreman,
- Leahy, T., General Foreman,
- Lewis, F. C., General Foreman,
- Kane, B., General Foreman,
- Ogden, J. E., Foreman,
- Remmel, L. J., Foreman,
- Davis, H. S., Building Foreman,
- Wilson, J. R., General Storekeeper,
- Clerkin, P. A., Roadmaster,
- Danks, H. L., Roadmaster,
- Gordon, F. H., Roadmaster,
- Single, J. L., Roadmaster,
- Hyde, F. G.

QUINCY HORSE RAILWAY & CARRYING CO.:

- Martin, W. A., Superintendent,
- McMillan, C. A.

RALEIGH ELECTRIC CO.:

- Dalton, H. H., Auditor,

RHODE ISLAND CO., THE:

- Potter, A. E., General Manager,
- Bronsdon, M. H., Chief Engineer,
- *Wright, W. D., Superintendent of Equipment,
- Purrington, H. F., Superintendent of Tracks,
- Brown, F. H., Superintendent,
- Shippen, A. L.,
- Campbell, A. L.,
- Jones, John.

RICHMOND & PETERSBURG ELECTRIC RAILWAY CO.:

- Huff, S. W., General Manager,
- Buchanan, C. B., Superintendent of Transportation,
- Whiteley, Calvin, Jr., Chief Engineer of Way,
- Whitfield, G. H., Mechanical and Electrical Engineer.

*Delegates of Member Companies* — (Continued).

RICHMOND LIGHT & RAILROAD CO.:
Phillips, J. E., Secretary,
*Mullen, T. J., Superintendent.

ROANOKE RAILWAY & ELECTRIC CO.:
Hancock, J. W., General Manager,
Bush, W. T., Superintendent Railway Department.

ROCHESTER RAILWAY CO.:
Cook, E. J., General Manager,
Hicks, J. W., Assistant General Manager,
*Wilcoxen, E. J., General Superintendent,
Linn, A. L., General Auditor,
Collins, J. C., Secretary and Auditor,
Tucker, C. A., Assistant Treasurer,
Matthews, I. E., Chief Engineer,
Cadle, C. L., Electrical Engineer,
Maize, F. P., Master Mechanic,
Butler, H. M., Purchasing Agent,
Eaton, J. B., Passenger Agent,
Sperry, T. H., Assistant Freight and Passenger Agent,
Livernash, F., Division Superintendent,
Griffin, W. R., Superintendent,
Gillette, W. H., Superintendent,
Ingle, W. O., Assistant Auditor,
Scobell, E. C., Assistant Auditor,
Byrne, D. A., Cashier,
Redman, C. M., Train and Roadmaster,
Kilbride, M. D., Trainmaster,
James, Frank, General Manager's Clerk,
Hicks, H. E., Superintendent's Clerk.

ROCKFORD & INTERURBAN RAILWAY CO.:
Ellis, T. M., General Manager,
McAssey, F. W., Auditor.

ROCKLAND, THOMASTON & CAMDEN STREET RAILWAY CO.:
Gannett, G. P., Engineer.

SAGINAW VALLEY TRACTION CO.:
Folsom, E. C., General Superintendent.
Weiss, W. F., Master Mechanic.

ST. JOSEPH RAILWAY, LIGHT, HEAT & POWER CO.:
Hewitt, C. F., General Superintendent.

SAN ANTONIO TRACTION CO.:
King, J. J., General Superintendent.

SAN DIEGO ELECTRIC RAILWAY CO.:
Kayser, A. H., General Auditor,
Perrin, M. J., Superintendent.

SAN JUAN LIGHT & TRANSIT CO.:
Conn, C. F., Special Representative,
Douds, H. J., Special Representative.

*Delegates of Member Companies* — (Continued).

SAVANNAH ELECTRIC CO.:
Eaton, R. H., Assistant Treasurer,
DeVane, W. C., Master Mechanic.

SCHENECTADY RAILWAY CO.:
Peck, E. F., General Manager,
Aitkin, J. H., Purchasing Agent,
Penoyer, B., Engineer Maintenance of Way,
Brown, F. A., Claim Agent,
Doyle, F. J., Master Mechanic,
Walsh, F., Manager of the Freight Department,
Hamilton, J. T., Assistant Superintendent,
Katz, D., Chief Clerk.

SCRANTON RAILWAY CO.:
Tingley, C. L. S., Secretary and Treasurer,
Pryor, F. J., Jr., Comptroller,
Caum, Frank, General Manager,
Reilly, P. T., Superintendent of Transportation,
Kibbe, A. S., Chief Engineer,
Ervien, J. H., Engineer,
May, W. W., Secretary.

SEATTLE ELECTRIC CO.:
Wyman, C. D., Vice-President,
Dabney, Frank, Assistant Treasurer,
Beckett, W. W., Accountant,
Lukes, J. B., General Superintendent.

SOUTH CHICAGO CITY RAILWAY CO.:
Gaither, W. R., Auditor.

SOUTHERN WISCONSIN RAILWAY CO.:
Montgomery D., Vice-President.

SOUTH SHORE TRACTION CO.:
Archibald, A. K., Engineer.

SOUTHWEST MISSOURI ELECTRIC RAILWAY CO.:
Pratt, E. J., Superintendent and Electrician,
Gunsalus, S. W., Superintendent of Transportation.

SOUTH-WESTERN TRACTION CO.:
*Mower, S. W., General Manager,
Roberts, D. P., Electrical Engineer.

SPRINGFIELD RAILWAY CO.:
Miller, J. H., General Manager.

SPRINGFIELD TRACTION CO.:
Bixby, W. A., Vice-President and General Manager.

STERLING, DIXON & EASTERN ELECTRIC RAILWAY CO.:
Smith, Clement C., Vice-President.

STONE & WEBSTER COMPANIES:
Pratt, A. S., Treasurer,
England, G. C., Assistant Treasurer,
Adams, E. R., Traveling Auditor,

*Delegates of Member Companies* — (Continued).

STONE & WEBSTER COMPANIES — *Continued:*
Allen, C. H., Traveling Auditor,
Leonard, W. R., Traveling Auditor,
Robinson, D. P.

SYRACUSE & SUBURBAN RAILROAD CO.:
Fiesinger, J., Auditor.

SYRACUSE, LAKE SHORE & NORTHERN RAILROAD:
Rockwell, W. B., General Manager.

SYRACUSE RAPID TRANSIT RAILWAY CO.:
Honold, P. J., Purchasing Agent,
Duffy, J. E., Superintendent,
DuBois, F. M., Master Mechanic,
Roundey, E. P., Engineer Maintenance of Way,
Ryan, Dr. F. H., Claim Agent,
Roundey, E. R.

TACOMA RAILWAY & POWER CO.:
Dimmock, W. S., Manager,
Michener, A. S., Accountant.

TAMPA ELECTRIC CO.:
Byrne, C. H., Assistant Treasurer.

TERRE HAUTE, INDIANAPOLIS & EASTERN TRACTION CO.:
Grover, T. F., Manager,
Morgan, C. E., Superintendent,
Tichenor, William, Claim Agent.

TOLEDO RAILWAYS & LIGHT CO.:
Lang, A. E., Director,
Beilstein, L. E., Vice-President,
Swift, H. S., Secretary and Auditor,
Ross, J. T., Chief Engineer,
Young, J., General Passenger Agent.

TORONTO RAILWAY CO., THE:
Fleming, R. J., General Manager,
Sweetlove, C. H., Engineer,
McCabe, P. H.,
Howden, J. W.

TRI-STATE TRACTION CO.:
Flood, J. F., General Manager.

TRI-CITY RAILWAY CO.:
Weeks, H. E., Secretary and Treasurer,
Huntoon, J. G., General Superintendent.

TWIN CITY RAPID TRANSIT CO.:
Goodrich, C. G., Vice-President,
Scofield, E. H., Chief Engineer,
Warnock, A. W., General Passenger Agent,
Wilson, G. L., Engineer and Roadmaster,
Conaughe, Clarence,
Kendrick, E. A.

*Delegates of Member Companies* — (Continued).

UNION STREET RAILWAY CO.:
- Wilde, E. S., Treasurer,
- Potter, E. E., General Superintendent,
- Morse, G. G., Master Mechanic.

UNITED RAILWAYS & ELECTRIC CO., THE (Baltimore):
- *Adams, H. H., Superintendent of Shops,
- Davis, Thomas, Engineer,
- Staub, W. H., Purchasing Agent,
- Stoll, J. A., Traffic Agent,
- Venable, Major Richard.

UNITED RAILWAYS CO. OF ST. LOUIS:
- McCulloch, Richard, Assistant General Manager,
- Henry, Frank R., Auditor,
- Price, J. B., Purchasing Agent,
- Hardin, C. B., General Claim Agent,
- O'Brien, M., Master Mechanic,
- Burgess, J. E., Superintendent of Wire,
- *Griffeth, M. R.

UNITED TRACTION CO.:
- Benedict, H. A., Electrical Engineer,
- Newberry, F. F., General Freight Agent.

UTICA & MOHAWK VALLEY RAILWAY CO.:
- Allen, C. L., Vice-President and General Manager,
- Joel, J. M., Auditor,
- Frankel, B. A., Cashier,
- Gerdon, F. J., Superintendent of Transportation,
- Harvie, W. J., Chief Engineer,
- French, M. J., Engineer Maintenance of Way,
- Williams, H. S., Assistant Electrical Engineer,
- McDougall, R. E., Claim Agent.

WASHINGTON, BALTIMORE & ANNAPOLIS ELECTRIC RAILWAY CO.:
- Shannahan, J. N., Vice-President and General Manager,
- Masterspon, J. G., Secretary and Treasurer,
- Gladfelter, C. F., Assistant Secretary and Treasurer,
- Kappler, W. A., Auditor,
- O'Hara, Joseph, Superintendent,
- Donovan, Henry, Engineer,
- Slaughter, W. E., General Passenger Agent,
- Harter, Bret.

WASHINGTON RAILWAY & ELECTRIC CO.:
- Harries, G. H., Vice-President,
- Ham, W. F., Comptroller,
- Fuller, H. W., General Manager,
- Kimball, C. S., Engineer Maintenance of Way,
- Whitehead, F. J., Claim Agent.

*Delegates of Member Companies*—(Continued).

WEST PENN RAILWAYS CO.:
  Scheck, G. W., Auditor,
  McCain, W. B., Assistant Auditor,
  Conklin, L. G., General Superintendent,
  Boyd, J. I., Purchasing Department,
  Brown, J. W., Superintendent of Transportation,
  Black, J., Division Superintendent,
  Wells, G. W., Master Mechanic.
WHATCOM COUNTY RAILWAY & LIGHT CO.:
  Hector, J. C., Assistant Treasurer.
WHEELING TRACTION CO.:
  Shank, A. M., Director
  Shirley, W. A., Secretary and Treasurer,
  Nagle, G. O., General Manager,
  Wright, Edward, Division Superintendent,
  Shank, Lawrence, Stock Clerk,
  Crawford, J. H., Master Mechanic,
  Lipphardt, Louis, Claim Agent.
WILLIAMSPORT PASSENGER RAILWAY CO.:
  *Herrick, C. T., Master Mechanic.
WINONA INTERURBAN RAILWAY CO.:
  Dickey, H. S., General Superintendent,
  Sigler, Charles, Master Mechanic,
  Wood, W. A., Special Agent.
WORCESTER CONSOLIDATED STREET RAILWAY CO.:
  Lester, J. W., Treasurer,
  Connette, E. G., General Manager,
  McCabe, John, Purchasing Agent.
YORK STREET RAILWAY CO.:
  Hayward, A. H., Vice-President,
  Young, David, Jr., General Manager,
  Grimes, H. T., Auditor,
  Mayer, L. C., Chief Engineer,
  Newman, F. R., Master Mechanic.
YOUNGSTOWN & SOUTHERN RAILWAY CO.:
  Dill, S. J., Vice-President and General Manager,
  Todd, David, Secretary and Treasurer,
  Andrews, R. L., Director.

## ASSOCIATE MEMBERS IN ATTENDANCE.

(*Allied with the Engineering Association.)

EDITOR'S NOTE:—The names of other associate members in attendance at the convention are given in the list of Delegates of Member Companies and are there designated by means of an asterisk (*).

*Alden, Charles A., Street Railway Engineer, Pennsylvania Steel Co.
*Bell, Thomas K., Chief Engineer, Interstate Railways Co.

*Associate Members in Attendance*— (Continued).

*Bigelow, Charles H., with L. B. Stillwell, Consulting Engineer.
Boyer, Warren L. Superintendent, New York Car & Truck Co.
Case, F. E., Engineer Railway Equipment, Pittsburg Railways Co.
Chilton, St. John, Engineer, Allis Chalmers Co.
*Clapp, Harold W., Electrical Engineer, General Electric Co.
*Duffy, James A., Master Mechanic, Pittsburg Railways Co.
Emory, G. W., Assistant Engineer Maintenance of Way, Pittsburg Railways Co.
Gibbs, C. A., Civil Engineer, Pittsburg Railways Co.
*Green, Alfred, Mechanical Expert, Galena Signal Oil Co.
Greenway, Bert, Assistant Engineer, Hudson Companies.
Hyde, E. N., Sales Department, Frank H. Stewart Electrical Co.
*Jones, P. N., Electrical and Mechanical Engineer, Pittsburg Railways Co.
*Killeen, G. C., Master Mechanic, New Jersey & Pennsylvania Traction Co.
Knowlen, J. F., Superintendent, North Alabama Traction Co.
Larned, J. M., Engineer Maintenance of Way, Pittsburg Railways Co.
McClure, A. G., Engineer, American Conduit Co.
*Munger, E. T., Master Mechanic, Metropolitan West Side Elevated Railway Co.
*Pellissier, G. E., Engineer, Goldschmidt Thermit Co.
*Reed, W. Boardman, Civil Engineer, New York City.
*Rogan, John A., Master Mechanic, Pittsburg Railways Co.
Shipper, I. D., Electrical Engineer, J. G. Brill Co.
*Slater, F. R., Electrical Engineer, 100 Broadway, New York City.
*Smith,G. J., Master Mechanic, Metropolitan West Side Elevated Railway Co.
Stewart, John A., President, John A. Stewart Electrical Co.
*Twells, H. N., Inspector, Philadelphia Rapid Transit Co.
Venning, F. J., Superintendent Overhead Lines, Pittsburg Railways Co.
Westinghouse, Church, Kerr & Company (Engineers), represented by F. R. Church, Engineer.
Weston, A. H., Mechanical Engineer, T. H. Symington Co.

## GUESTS IN ATTENDANCE.

(Representatives of Street and Interurban Railway Companies.)

ATLANTIC CITY & SHORE RAILROAD:
    Isenthal, L. R., Secretary,
    Neff, S. S., General Superintendent.
BANKS COUNTY ELECTRIC RAILWAY:
    Janney, M., General Manager.
BEAVER VALLEY TRACTION CO.:
    Lightfoot, J. C., Jr., Assistant Treasurer.

*Guests in Attendance* — (Continued).

BERKSHIRE STREET RAILWAY CO.:
Nary, W. T., Superintendent.

BLUE HILL STREET RAILWAY CO.:
Winslow, C. H., Assistant Treasurer.

BROOKLYN RAPID TRANSIT CO.:
Poe, C. W., Assistant Superintendent.

BURLINGTON COUNTY RAILWAY CO.:
Gilbert, John S., General Manager,
Jones, T. B., Superintendent.

BUTLER PASSENGER RAILWAY CO.:
Bauer, L. P., Superintendent.

CAMDEN & TRENTON RAILWAY CO.:
Goldey, P. R., Superintendent.

CAPE BRETON ELECTIC CO.:
Leitch, J. H., Assistant Treasurer.

CHAUTAUQUA TRACTION CO.:
Price, Gaylord, Master Mechanic.

CHESTER TRACTION CO.:
Jack, A. G., Superintendent,
McDonough, M. J., Cashier,
Anthony, E. L., Chief Engineer,
Snyder, C. N., Roadmaster.

CINCINNATI, LAWRENCEBURG & AURORA ELECTRIC STREET RAILROAD CO:
Hooven, C. E., Treasurer and Manager,
Graybill, J. S., Jr., Secretary and Treasurer,
Charles, S. T., Superintendent of Transportation,
Connelly, F. B., Master Mechanic.

CONEY ISLAND & BROOKLYN RAILROAD CO.:
Van Styck, C. H., Electrical Engineer.

CONNEAUT & ERIE TRACTION CO.:
Flynn, C. E., President.

DELAWARE COUNTY & PHILADELPHIA ELECTRIC RAILROAD CO.:
Rostron, J. E., Chief Engineer.

EASTERN PENNSYLVANIA RAILWAY CO.:
Bradley, L. C., Manager,
Potter, H. W., Purchasing Agent,
Lentz, N. M.

EAST SHORE & SUBURBAN RAILWAY CO.:
Robertson, C. H., Superintendent.

EXETER, HAMPTON & AMESBURY STREET RAILWAY CO.:
MacAdams, J. A., Superintendent.

HOLYOKE STREET RAILWAY CO.:
Chapin, G. L., Electrical Engineer,
Pillmen, L. D.,
Hunter, M. G.

*Guests in Attendance*—(Continued).

HUDSON COMPANIES:
- Baker, C. F.

HUDSON VALLEY RAILWAY CO.:
- Van Wirt, D. E., Chief Engineer.

INLAND EMPIRE SYSTEM:
- Flagg, C. E., Publicity Agent.

INTERSTATE RAILWAYS CO.:
- Buggy, J. A., Superintendent,
- Rosen, W. A., Auditor,
- Long, C. C., Engineer,
- Tyson, F. A., Engineer,
- Handword, H. S., Assistant Purchasing Agent,
- Haas, Fred., Press Agent.

INTERBOROUGH RAPID TRANSIT CO.:
- Norris, H. M.

KANAWHA VALLEY TRACTION CO.:
- Alexander, E. W., General Manager,
- Heald, W. L., Treasurer.

LEBANON VALLEY STREET RAILWAY CO.:
- Smith, C. H., Superintendent.

MOUNT VERNON ELECTRIC RAILWAY CO.:
- Selig, E. T., Manager.

NIAGARA GORGE RAILROAD:
- Nicklis, E. E., Superintendent,
- Fraley, H. M.,
- Kruger, L.
- Liger, F.,
- Meehan, J. J.,
- Piper, W.,
- Powell, C.,
- Ramsdell, E.,
- Ramsdell, F.,
- Thompson, F.

NORTHERN CAMBRIA STREET RAILWAY CO.:
- McNelis, J. L., Superintendent,
- Bigler, H. F., Treasurer.

NORTHERN ELECTRIC STREET RAILWAY CO.:
- Hagenlocher, C. P.

NORTHERN ILLINOIS LIGHT & TRACTION CO.:
- Hess, L. W., Secretary and General Manager.

OGDENSBURG STREET RAILWAY CO.:
- Hawkins, E. E., President,
- Roe, Austin.

PHILADELPHIA & EASTON ELECTRIC RAILWAY CO.:
- Lugar, J. C., Secretary and Manager,
- Steele, H. E., Master Mechanic.

*Guests in Attendance*—(Continued).

PHILADELPHIA & WESTERN RAILWAY CO.:
Davey, John, Electrical Engineer.

PHILADELPHIA, BRISTOL & TRENTON STREET RAILWAY:
Glazier, Henry, General Superintendent.

PITTSBURG & WESTMORELAND RAILWAY CO.:
Stires, Manning, President.

PITTSBURGH, MCKEESPORT & GREENSBURG RAILWAY CO.:
Coffey, M. A., Superintendent.

PITTSBURG RAILWAYS CO.:
Lappan, James.

PORTLAND & BRUNSWICK STREET RAILWAY CO.:
Gerald, A. F., General Manager.

PORT VUE STREET RAILWAY CO.:
Myer, G. W.

SHORE FAST LINE:
Evans, Hon. Charles, Vice-President.

SPRINGFIELD STREET RAILWAY CO.:
Page, H. C., General Manager,
Dickson, E. J., Chief Clerk to Vice-President,
Chase, E.,
Sumner, F.

TRENTON STREET RAILWAY CO.:
Hurley, P. E., General Manager.

TORONTO & YORK RADIAL RAILWAY CO.:
Deadey, J. F., Superintendent,
Wilson, C. L., Assistant General Manager,
Beasley, H. H.,
Hubbard, F. L.

UNITED TRACTION CO. (Reading, Pa.):
Bryon, Claude, Division Engineer,
Becker, J. S., Trackmaster,
Gould, J. L., Master Mechanic.

WILMINGTON CITY RAILWAY CO.:
Hoff, S. S., General Manager.

WINNEPEG ELECTRIC RAILWAY CO.:
Garrett, G.

WASHINGTON, ALEXANDRIA & MOUNT VERNON RAILWAY CO.:
Colvin, Joseph, Superintendent.

WEST JERSEY & SEASHORE RAILROAD:
Lovell, D. H., Superintendent,
Plummer, A. M., Superintendent of Power Station,
Spangler, W. N., Supervisor of Signals,
Broadbent, J. H., Assistant Supervisor,
Atkinson, E. F., Freight Agent.

(Other Guests.)

Anderson, J. C., Westinghouse, Church, Kerr & Co.
Appelgate, F. N., New York, N. Y.
Arnold, F. L., Superintendent, Alliance Against Accident Fraud.
Atkinson, E. M., Freight Department, Pennsylvania Railroad Co.
Atkinson, W. V., Freight Agent, Pennsylvania Railroad Co.
Baker, W. H., Atlantic City Steel Pier Co.
Balch, C. F., Interstate Commerce Commission, Washington, D. C.
Beckwith, E. B., New York, New Haven & Hartford Railroad Co.
Bell, A. T., President, Hotel Men's Association, Atlantic City, N. J.
Bell, W. B., Atlantic City, N. J.
Brazier, F. W., New York, N. Y.
Brown, A. A., Westinghouse, Church, Kerr & Co.
Burk, Alfred E., Vice-President, Atlantic City Steel Pier Co.
Butler, A. F., Assistant Treasurer, The Lowell Electric Light Corporation.
Caum, Norman, Scranton, Pa.
Clark, F. N., Farrell's Car Line, Omaha, Neb.
Chase, C. W., Assistant Treasurer, Edison Illuminating Co.
Cratzer, C. A., Pennsylvania Railroad Co.
Crossman, T. E., Official Stenographer, New York, N. Y.
Davidson, T. C., Atlantic City, N. J.
Davis, H. P., Assistant Chief Engineer, Westinghouse Electric & Manufacturing Co.
Edwards, H. M., Auditor, New York Edison Co.
Farrand, Dudley, President, National Electric Light Association.
Franklin, Wallace, Westinghouse, Church, Kerr & Co.
Freeman, W. W., Secretary and Treasurer, National Electric Light Association.
Fisher, G. E., Fidelity Construction Co., Detroit, Mich.
Godfrey, Carlton, Atlantic City, N. J.
Graham, G. E., Electrical Engineer, Delaware & Hudson R. R. Co.
Hackney, J. W., Atlantic City, N. J.
Harrold, J. W., Chief Clerk, Pennsylvania R. R. Co.
Hoey, J. J., New York, N. Y.
Hunt, C., Baltimore, Md.
Hunt, W. B., Baltimore, Md.
Hunter, Harry, Philadelphia & Reading R. R. Co.
Ingram, A. B., Vice-Chairman, Ontario Railway and Municipal Board.
Kauffman, G. B., Philadelphia & Reading R. R. Co.
Kittson, H. N., Toronto, Ontario.
Kramer, Louis, Cincinnati, Ohio.
Kruesi, A. H., Engineer, General Electric Co., Schenectady, N. Y.
Lambert, W. W., Manager, Philadelphia Air Brake & Machine Co.
Linall, H. C., Ontario Railway and Municipal Board.

*Guests in Attendance*—(Continued).

McCausland, A. G., Philadelphia & Reading.
Mackay, H. C., Comptroller, Norfolk Southern Railroad Co.
Marston, Glenn, M. O. Publishing Bureau, New York, N. Y.
Meyer, W. J., New York State Railroad Commission.
Monks, J. A., Ticket Agent, Pennsylvania R. R. Co.
Nordin, Dr., Atlantic City, N. J.
Palmer, W. J., Jamestown Exposition, Norfolk, Va.
Raeburn, Andrew, Westinghouse, Church, Kerr & Co.
Randall, R. L., Official Stenographer, New York, N. Y.
Roseman, E. A., Telegraph Operator, Pennsylvania R. R. Co.
Rugg, H. V., District Engineer, Westinghouse Electric & Manufacturing Co.
Runkel, W. T., Pennsylvania R. R. Co.
Sewall, H. B., Treasurer, Minneapolis General Electric Co.
Smith, G. P., Meriden, Conn.
Smith, R. D., President, Central Illinois Construction Co.
Stern, W. A., Philadelphia, Pa.
Steuart, W. M., Statistician, Department of Commerce and Labor, Washington, D. C.
Stockbenger, F. L., Cleveland, Ohio.
Sweetland, Ralph, National Fire Protection Association, Boston, Mass.
Trowbridge, W. B., Westinghouse, Church, Kerr & Co.
Twombley, A. H., Westinghouse, Church, Kerr & Co.
Warner, F. B., Cashier, Ontario Power Co. of Morgan Falls.
Weaver, A. B., Official Stenographer, New York, N. Y.
Wilkinson, Thomas, American Press Association, New York, N. Y.
Wilson, C. G., Westinghouse, Church, Kerr & Co.
Wood, B. F., Pennsylvania R. R. Co.
Wood, Walter, Fitchburg, Mass.

## LADIES IN ATTENDANCE.

Adams, Mrs. H. H.
Alden, Mrs. C. A.
Alexander, Mrs. E. W.
Andrews, Mrs. R. L.
Armstrong, Miss Lillian.
Arnold, Miss Maud.
Arnold, Mrs. W. L.
Atkin, Mrs. G. H.
Atkinson, Mrs. B. C.
Bagg, Mrs. F. W.
Bailey, Mrs. F. A.
Baker, Mrs. C. F.
Banghart, Mrs. S. L.
Barker, Mrs. George.
Battin, Mrs. C. H.
Beaulieu, Mrs. D. L.
Beaulieu, Miss Edith.
Bell, Mrs. E. D.
Bell, Miss H. W.
Bell, Mrs. W. B.
Bernedurg, Mrs. T. A.
Bigler, Miss.
Bigler, Mrs. H. F.
Bixby, Mrs. F. A.
Bixby, Mrs. W. A.
Bower, Miss Anna B.
Bower, Miss Augusta B.
Boylan, Mrs. M. R.
Bradley, Mrs. L. C.
Brown, Mrs. A. A.
Brunner, Mrs. Charles B.
Bryant, Mrs. C. F.
Bullen, Mrs. Harry.
Burgess, Mrs. J. E.
Burton, Miss E. W.
Butman, Mrs. George A.
Carney, Miss M.
Carpenter, Mrs. E. C.
Carll, Mrs. L. M.
Case, Mrs. F. E.
Casey, Mrs. T. W.
Caum, Mrs. Frank.
Chambers, Mrs. George.
Chambers, Miss M. A.
Clark, Mrs. F. N.
Classen, Mrs. A. H.
Collard, Mrs. B.
Collins, Mrs. J. C.
Collins, Mrs. W. H.
Connette, Mrs. E. G.
Corning, Mrs. John W.
Corse, Mrs. Bettie.
Crafts, Mrs. P. P.
Crane, Mrs. S. S.
Cratzer, Mrs. Curtin A.
Cratzer, Miss Mary L.
Crawford, Mrs. J. H.
Currie, Mrs. Charles.
Cummins, Mrs. F. S.
Davey, Mrs. John.
Davis, Mrs. Thomas.
Dickey, Mrs. H. S.
Dimmock, Mrs. W. S.
Donnelly, Mrs. T. B.
Douglass, Mrs. J. C.
Du Bois, Mrs. F. M.
Duffey, Mrs. Edwin.
Duffy, Mrs. C. H.
Duffy, Mrs. J. E.
Dyer, Miss Kate M.
Evans, Mrs. W. H.
Fairchild, Mrs. C. B., Jr.
Fairchild, Miss C. L.
Fehr, Mrs. H. R.
Ferrandou, Mrs. H. A.
Files, Mrs. O. F.
Flinn, Miss M.
Flood, Mrs. J. F.
Flood, Miss Kate.
Folsom, Mrs. E. C.
Frazer, Mrs. W. M.
Freeman, Mrs. W. W.
French, Mrs. M. J.
Frost, Mrs. D. C.
Fuerlicht, Miss Rose.
Fuller, Mrs. H. W.
Fullerton, Mrs. Irwin.
Gaboury, Mrs. A. G.

*Ladies in Attendance*—(Continued).

Gahan, Mrs. G. H.
Gannett, Mrs. Guy P.
Gannon, Mrs. G. J.
Geesey, Miss W. R.
Gherky, Mrs. W. D.
Gilbert, Mrs. John.
Glenn, Mrs. W. H.
Goshorn, Mrs. H. R.
Goshorn, Miss.
Gow, Mrs. Helen H.
Graham, Mrs. W. B.
Gregory, Mrs. T. W.
Groce, Mrs.
Hagenlocher, Mrs. C. P.
Hall, Mrs. Frederick D.
Ham, Mrs. W. F.
Hanf, Mrs. John.
Hardin, Mrs. C. B.
Harrigan, Mrs. J. R.
Harrington, Mrs. W. E.
Harris, Mrs. G. A.
Hathaway, Mrs. E. C.
Hegarty, Mrs. D. A.
Henry, Mrs. C. L.
Henry, Mrs. Frank R.
Henry, Miss Leah.
Herrick, Miss M.
Hewitt, Mrs. C.
Hicks, Mrs. J. W.
Hine, Mrs. E. W.
Hinkley, Mrs. J. W., Jr.
Hippee, Mrs. G. M.
Hires, Mrs. B. F.
Honold, Mrs. P. J.
Hooven, Mrs. C. E.
Hubbell, Mrs. H. P.
Hunt, Miss F. B.
Inskeep, Mrs. R. E.
Jackson, Mrs. R. F.
Joel, Mrs. J. M.
Johnson, Mrs. Benjamin.
Johnson, Miss Claire.
Kayser, Mrs. A. H.
Kramer, Mrs. Louis.
King, Mrs. J. J.
Lahr, Mrs. Charles.
Lee, Mrs. George.
Leitch, Mrs. James.
Linn, Mrs. A. L., Jr.
Longmire, Mrs. E. A.
Lugar, Mrs. J. C.
Lukes, Mrs. J. R.
MacAllister, Mrs. M. J.
McCulloch, Mrs. Richard.
McDole, Mrs. W. G.
McFee, Mrs. G. H.
Marfield, Mrs. T. N.
Mahlen, Mrs. Edward.
Maize, Mrs. William.
Mackay, Mrs. H. C.
Marsh, Mrs. H.
Martin, Mrs. James M.
Mathews, Mrs. W. G.
Merker, Mrs. H. F.
Metcalf, Miss C. L.
Miller, Mrs. H.
Morgan, Mrs. C. E.
Morrill, Mrs. F.
Morse, Mrs. G. C.
Mulholland, Mrs. W. J.
Mullen, Mrs. T. J.
Munger, Mrs. E. T.
Musser, Mrs. Frank B.
Myer, Mrs. G. F.
Nagle, Mrs. G. O.
Nobel, Mrs. H. G.
Neff, Mrs. S. S.
O'Brien, Mrs. M.
O'Brien, Miss Sarah.
Ogden, Miss Elizabeth H.
Ogden, Miss Lillian M.
Parker, Mrs. G. W.
Peck, Mrs. E. F.
Phillips, Mrs. J. E.
Polk, Mrs. H. H.
Potter, Mrs. E. E.
Powell, Mrs. A. T.
Pratt, Mrs. M. B.
Prescott, Mrs. J. A.
Price, Mrs. W. G.
Pryor, Mrs. F. J., Jr.
Qualey, Mrs. W. M.

*Ladies in Attendance*—(Continued).

Reel, Mrs. C. Gordon.
Reed, Mrs. W. Boardman.
Remelius, Mrs. C. R.
Richey, Mrs. Albert S.
Rifenberick, Miss E.
Roberts, Mrs. E. R.
Roe, Mrs. Austin.
Root, Mrs. L. C.
Rudderow, Mrs. R. W.
Ryan, Mrs. Francis J.
Schoenen, Mrs. R. H.
Scott, Mrs. C. B.
Sears, Mrs. R. A.
Seitz, Mrs. L.
Shank, Mrs. Albert.
Shannahan, Mrs. J. M.
Shaughnessy, Mrs. T.
Shipper, Mrs. I. D.
Simmons, Mrs. F. G.
Slater, Mrs. F. R.
Slocum, Mrs. J. F.
Smith, Mrs. F. E.
Smith, Miss H. E.
Smith, Mrs. R. D.
Spillane, Mrs. N. P.
Staats, Mrs. Henry N.
Staub, Mrs. W. H.
Stebbins, Mrs. Theodore.
Stewart, Miss M. R.
Stewart, Miss Mary.
Stemsen, Mrs. R. T.
Stone, Mrs. George.
Sturgeon, Mrs. T. L.
Sweetland, Mrs. Ralph.
Thompson, Mrs. S. B.
Tichenor, Mrs. William.
Todd, Mrs. R. I.
Tullinger, Mrs. V. E.
Veal, Mrs. Samuel.
Vordermark, Mrs. H. E.
Walmsley, Mrs. J. F.
Walsh, Mrs. J. M.
Warner, Miss Jean.
Warren, Mrs. Herbert.
Watkins, Mrs.
Weeks, Mrs. H. F.
Weh, Mrs. W. F.
Weir, Mrs. C. E.
Wilkinson, Mrs. Thomas.
Wilson, Miss Ruth.
Wood, Mrs. B. F.
Wood, Miss Ida M.
Wood, Mrs. Thomas S.
Woodman, Miss Ethel.
Woodman, Mrs. Franklin.
Wright, Mrs. Edward
Wuichet, Mrs. Eugene.

## REPRESENTATIVES OF THE TECHNICAL PRESS.

### *Electrical Review.*

Price, Charles W., President.

Gray, Ainslie A., Managing Editor.

Qualey, William M., Assistant Office Manager.

### *Electric Traction Weekly.*

Kenfield, H. J., President and General Manager.

Fairchild, C. B., Jr., Vice-President and Editor.

Davis, George S., Secretary and Associate Editor.

Standish, Robert Miles, Eastern Representative.

### *Engineering News.*

Wight, F. C., Assistant Editor.

Barker, Harry, Assistant Editor.

### *Railroad Gazette.*

Simmons, E. A., Vice-President.

Chisolm, R. S., Business Manager.

Fowler, George L., Associate Editor.

Hitt, Rodney, Associate Editor.

### *McGraw Publishing Co.*

McGraw, James H., President.

Wakeman, J. M., Vice-President.

Blake, H. W., Editor, *Street Railway Journal.*

Babtiste, C. A., *Street Railway Journal.*

Beard, W. K., *Street Railway Journal.*

Onken, W. J., Jr., *Electrical World.*

Gough, Cale, *Street Railway Journal.*

Jackson, Walter, *Street Railway Journal.*

Walker, C. T.

Doyle, C. J.

### *Western Electrician.*

Perry, F. L., Assistant Business Manager, Chicago.

Wood, E. E., Eastern Manager, New York.

### *The Wilson Co.*

Wilson, H. M., President.

Gould, L. E., Editor, *Electric Railway Review.*

Royse, Daniel, *Railway Age.*

Nind, J. N., Jr., *Electric Railway Review.*

Nicholas, Frederick, *Electric Railway Review.*

Lane, H. F., *Electric Railway Review.*

Kimball, B. M., *Electric Railway Review.*

Mills, C. P., *Electric Railway Review.*

Bennett, J. B., *Electric Railway Review.*

Padget, W. P., *Electric Railway Review.*

## REPRESENTATIVES OF THE SECRETARY'S OFFICE.

Swenson, Bernard V., Secretary and Treasurer.
Ellis, Frank E., Assistant to the Secretary.
Bryant, C. F.
Cox, Miss Georgia.
Doyle, Miss Elizabeth.
Schriefer, George.

# EXHIBIT OF MANUFACTURERS' ASSOCIATION.

The Atlantic City exhibit of the American Street and Interurban Railway Manufacturers' Association was larger and more comprehensive than ever before. Approximately two hundred different companies had exhibits, and the net floor space used for exhibit purposes was considerably more than that used at the 1906 convention exhibit in Columbus, being approximately eighty-seven thousand square feet. A complete list of the members of the Manufacturers' Association follows:

*Adams & Westlake Co.
*Allis-Chalmers Co.
*American Brake Co.
*American Brake Shoe and Foundry Co.
*American Car Co.
American Car and Foundry Co.
American Car and Ship Hardware Co.
*American Railway Supply Co.
*American Locomotive Co.
*American Mason Safety Tread Co.
*American Sewer Pipe Co.
*American Steel and Wire Co.
*Anderson, A. & J. M. Mfg. Co.
*Atha Steel Casting Co.
Atlanta Car Wheel and Mfg. Co.
*Atlas Railway Supply Co.
*Automatic Trolley Guard Co.
*American Ferrofix Brazing Co.
*Addressograph Co.
*Acme Supply Co.
*American Multigraph Sales Co.
Atlas Anchor Co.
American Steel Foundries.
Aluminum Co. of America.
American Carbon and Battery Co.
Archibold Brady Co.
American Electric Works.
*American Blower Co.
*Baldwin Locomotive Works.
Barbour-Stockwell Co.
*Bayonet Trolley Harp Co.
*Beckwith, Chandler Co.
*Berry Bros., Limited.
Bishop Gutta Percha Co.
*Blake Signal and Mfg. Co.
*Booth, L. M. & Co.
Brady Brass Co.
*J. G. Brill Co.
*Brown, Harold P.
*Buckeye Engine Co.
Buda Foundry and Mfg. Co.
*Buhme Metal Packing Co.
Burdett Rowntree Mfg. Co.
*Burroughs Adding Machine Co.
*Bache & Co., Semon.
Bullard Automatic Wrench Co.
*Ball & Wood.
*Calman, Emil & Co.
*Cambria Steel Co.
*Carnegie Steel Co.
*Chicago Pneumatic Tool Co.
*Chicago Varnish Co.
Cincinnati Car Co.
Cleveland Frog and Crossing Co.
*Climax Stock Guard Co.
Coe, W. H., Mfg. Co.
*Columbia Machine Works and Mall. Iron Co.
*Columbia Nut and Bolt Co.
*Consolidated Car Fender Co.
*Consolidated Car Heating Co.
*Cook Standard Tool Co.

*Indicates that the company named had an exhibit.

*Exhibit of the Manufacturers' Association* — (Continued).

*Crouse-Hinds Co.
*Curtain Supply Co.
*Car Ventilating and Heating Co.
*Crocker-Wheeler Co.
*Coin Counting Machine Co.
*Compound Magnet Brake Co.
*Cooper Heater Co.
*D. & W. Fuse Co.
Dayton Mfg. Co.
*Device Improvement Co.
*Dixon, Jos., Crucible Co.
*Dearborn Drug and Chemical Co.
Decatur Car Wheel and Mfg. Co.
*Dilworth Porter & Co.
*Dossert & Co.
*Dressel Railway Lamp Works.
*Duff Mfg. Co.
*Durkin Controller Handle Co.
*Danville Car Co.
*Dolt Coin Handling Machine Co.
*Earll, C. I.
*Eclipse Railway Supply Co.
*Edwards, O. M. Co.
*Electric Railway Equipment Co., Phila.
*Electric Railway Equipment Co., Cinn.
*Electric Railway Improvement Co.
*Electric Storage Battery Co.
*Electric Service Supplies Co.
*Electrical Review.
*Electric Traction Supply Co.
*Eureka Automatic Electric Signal Co.
*Evans, Almirall Co.
*Eureka Tempered Copper Works.
*Egry Register Co.
*Etter Co., Chas. F.
*Elliott-Fisher Co.
Falk Co.
Fay Co., J. A. & Egan.
*Flexible Compound Co.
*Flood & Conklin Co.
*Franklin Car Heating Co.
*Franklin Electric Mfg. Co.
*France Packing Co.
*Galena Signal Oil Co.
*Garlock Packing Co.
*General Electric Co.
Glidden Varnish Co.
*Globe Ticket Co.
*Gold Car Heating and Lighting Co.
*Goldschmidt Thermit Co.
*Gould Storage Battery Co.
*Griffin Wheel Co.
*Gibson Iron Co.
*General Fireproofing Co.
*Grothwell, A.
*Grip Nut Co.
*Hale & Kilburn Co.
*Harrison, F. P., Electric Mfg. Co.
*Heany Fireproof Wire Co.
Herrick, Albert B.
*Haywood Bros. & Wakefield Co.
Hildreth Varnish Co.
*Home Rubber Co.
Hunt, C. W., Co.
Hunter Illuminated Car Sign Co.
*Holophane Co.
*Holmes & Allen.
*Howe Mfg. Co.
*Hayward & Co., S. F.
*Harrington, Daniel.
Indianapolis Switch and Frog Co.
*International Register Co.
International Sprinkler Co.
Industrial Magazine.
Jewett Car Co.
*Johns, H. W., Manville Co.
Johnson, Chas. F.
*Jones & Laughlin Steel Co.
*Justice, P. S., & Co.
*Kalamazoo Railway Supply Co.
Keystone Varnish Co.
*Kinnear Mfg. Co.
*Kuhlman, G. C., Car Co.

*Exhibit of the Manufacturers' Association* — (Continued).

*Kenfield, Fairchild, Publishing Co.
*Kerschner, W. R.
Lobdell Car Wheel Co.
*Lorain Steel Co.
*Lord Electric Co.
*Lord, Geo. W., Co.
*Lumen Bearing Co.
*Lackawanna Steel Co.
*Los Angeles Switch & Signal Co.
*Locke Insulator Co.
Long Co., E. G.
"Le Carbone" Carbon Brush Mfg. Co.
*Magann Air Brake Co.
*Maryland Steel Co.
*Massachusetts Chemical Co.
*Masury, John W. & Son.
*McDonald Ticket and Ticket Box Co.
*McGraw Publishing Co.
McGuire-Cummings Co.
*Midvale Steel Co.
More-Jones Brass Mfg. Co.
*Morris, Elmer P. & Co.
Murphy Varnish Co.
*Moran Flexible Steam Joint Co.
*Maryland Railway Supply Co.
*McCardell, J. R. & Co.
*McConway & Torley Co.
McIlvain & Co., J. Gibson.
*National Brake Co.
*National Brake and Electric Co.
*National Car Wheel Co.
*National Carbon Co.
*National Lock Washer Co.
*New Departure Mfg. Co.
New England Street Railway Club.
*Newman Clock Co.
*New York Car & Truck Co.
*New York Switch and Crossing Co.
*Niles Car and Mfg. Co.
*Nuttall, R. D. & Co.
*Norton Grinding Co.
Nicholas, G. S. & Co.
*National Fibre and Insulation Co.
Niles Bement Pond Co.
*New York Car Wheel Co.
*Ohio Brass Co.
*Ohmer Fare Register Co.
Okonite Co., Ltd.
Oliver Machinery Co.
*Pantasote Leather Co.
Partridge, Arthur S.
Patton Paint Co.
*Peerless Rubber Co.
*Pennsylvania Steel Co.
*Pittsburg Insulating Co.
*Plomo Specialty Mfg. Co.
Pressed Steel Car Co.
*Philadelphia Air Brake and Machinery Co.
*Pittsburg Pole and Forge Co.
*Palmetto Metal Co.
*Pike Adding Machine Co.
*Philadelphia Electric Con. Co. (See Holmes & Allen.)
*Pay as You Enter Car Co.
Post & Co., E. L.
*Picrome Hide Co.
*Quincy, Manchester, Sargent Co.
*Rail Joint Co.
*Railroad Gazette.
*Ramapo Iron Works.
Rand Avery Supply Co.
*Recording Fare Register Co.
Ridlon Co., Frank.
*Riverside Metal Co.
Roebling & Sons Co., John A.
Rossiter, McGovern & Co.
*Rubberset Brush Co.
Ryerson & Son, Jos. T.
*Railway Audit and Inspection Co.
*Rooke Automatic Register Co.
Railways Materials Co.
*Russell Car & Snow Plow Co.
*Rider & Orth.

*Exhibit of the Manufacturers' Association* — (Concluded).

- *Sherwin-Williams Co.
- *Schoen Steel Wheel Co.
- *Smith Heater Co., Peter.
- *Southern Exchange Co.
- *Spear & Miller Co.
- *Speer Carbon Co.
- St. Louis Car Co.
- St. Louis Car Heating Co.
- Standard Brake Shoe Co.
- *Standard Motor Truck Co.
- *Standard Paint Co.
- *Standard Steel Works.
- *Standard Underground Cable Co.
- *Standard Varnish Works.
- *Star Brass Works.
- *Stephenson Co., John.
- *Sterling, Meaker, Co.
- *Sterling Varnish Co.
- *Symington, T. H., Co.
- *Standard Roller Bearing Co.
- *Samson Cordage Co.
- *Stromberg, Carlson, Mfg. Co.
- *Smith Computing Table Co.
- *Standard Automatic Trolley Retriever Co.
- *Security Register Co. of St. Louis.
- *Taylor Electric Truck Co
- Thiel Detective Service Co.
- Trolley Supply Co.
- *Traction Railroad Equipment Co.
- *United Uniform Co., Wm. Shapiro.
- *Under-Feed Stoker Co. of America.
- *Union Electric Co.
- *United Copper Foundry Co.
- *United States Electric Signal Co.
- *United States Engineering Co.
- *United States Gauge Co.
- *United States Metal and Mfg. Co.
- *Underwood, H. B., & Co.
- *United States Graphite Co.
- *Universal Adding Machine Co.
- Valentine & Co.
- *Van Dorn, W. T., Co.
- *Van Dorn Electric and Dutton Co.
- *Wilson Co., The (*Electric Railway Review*).
- *Wallace Supply Co.
- *Wason Mfg. Co.
- Watson, Stillman Co.
- *Wendell & MacDuffie.
- *Western Electric Co.
- *Westinghouse Air Brake Co.
- *Westinghouse Electric and Mfg. Co.
- *Westinghouse Machine Co.
- *Westinghouse Traction Brake Co.
- *Weston Electrical Instrument Co.
- *Wharton, Wm. J., & Co., Inc.
- *Wheel Trueing Brake Shoe Co.
- *Wilson, Jas. G., Mfg. Co.
- *Wilson Trolley Catcher Co.
- *Washburn Steel Casting and Coupler Co.
- *Western Tube Co.
- *White, J. G., & Co.
- *Walworth Mfg. Co.
- *Yale & Towne Mfg. Co.

## ENTERTAINMENT.

As in the past, the American Street and Interurban Railway Manufacturers' Association provided many forms of entertainment during the convention week, among which may be mentioned the following:

An informal entertainment was given on Monday evening at the Marlborough-Blenheim hotel, readings being given by Miss Kitty Cheatham.

On Tuesday evening the annual reception and ball was given at the Marlborough-Blenheim hotel.

On Wednesday evening the entire seating capacities of Young's Pier theater and the Savoy theater were placed at the disposal of the convention people. " The Top o' the World " was presented at Young's Pier theater, while Mary Mannering played " Glorious Betsy " at the Savoy.

On Thursday evening occurred the third annual Supply Men's Amateur Vaudeville and Theatrical Performance, which was presented at Young's Pier theater.

On Friday evening an informal entertainment was given at the Marlborough-Blenheim hotel.

# MINUTES

OF THE

# 1907 CONVENTION.

## WEDNESDAY MORNING SESSION

### October 16, 1907

The twenty-sixth annual convention of the American Street and Interurban Railway Association was called to order at 10:30 A. M. by the president, Mr. John I. Beggs of Milwaukee, Wis., in Casino Hall, Steel Pier, Atlantic City, New Jersey.

Following the custom of previous meetings, the printed proceedings of the 1906 convention were approved, instead of the minutes being read. The roll call was also dispensed with, the registration at the door being accepted instead.

President Beggs:— We meet here in a unique city; one which has a residential population of approximately 40,000 inhabitants, with nearly 800 hotels and private boarding houses, and, as many of you have experienced during the last two or three days, some of these hotels are among the finest in the whole world. This city has at times for days together a transient population of nearly 300,000 people, and that many times during the season. It was largely because of the ample hotel accommodations and their superb character, that we decided to hold our 1907 annual meeting at Atlantic City.

One thing that has impressed me is this unceasing action of Old Ocean rolling in here on this beach, very much like the lives of those of us who are actively engaged in the business of operating street and interurban railways, because if our work is well performed, our activities are just as ceaseless as are these waves, rolling in on this sandy beach.

I now have the pleasure of introducing to you his Honor, Mayor Stoy of Atlantic City, who will extend to you a welcome.

## MAYOR STOY'S ADDRESS.

*Mr. President, Delegates and Visiting Friends:*

Through the courtesy of your secretary a few days ago, I am here this morning for a brief stay and to say a few words to this convention. In the beginning, I wish to express myself this way, that I am in the midst of one of the greatest conventions that has ever come together in this city. Coming, as you do, from all parts of this great country, it is a pleasure to stand here this morning as an official of the city and say welcome to you as a body, and while doing this, Mr. President and members, I feel that it is my duty also to extend to you the freedom of the city.

Yours is one of the greatest conventions in the country. We realize the importance of this convention and others similar to it, and we pride ourselves in saying that we have the convention city of the United States, at least the room and the hotels, and we always have an open hand to shake and bid you welcome to our city. This is what I am here to do this morning.

I want to say a few words concerning the possibility of some day having in our city a convention hall equal to take care of anything that may come to our city, perhaps accommodating two delegations like this. The Hotel Men's Association and a number of enterprising citizens have taken the matter up and propose to provide a hall for this purpose. It is astonishing to me, when you come to this city with the paraphernalia which you have on this pier, and have it placed in position in such a short time — it is a miracle how it is done.

We pride ourselves on having the facilities to accommodate these things, and to place them where you want them. This is done almost entirely through the association of hotel men and I trust in the near future that matters which may come before you for discussion in reference to a convention hall, for your own benefit, and the benefit of the manufacturers, that you will consider well before you leave Atlantic City whether it is not the proper place year after year, or at least until some one will offer you something better than that which we have in store for you. This proposition of ours is something that cannot be equalled in the United States.

Mr. President, with these few words, not wanting to detain you in your business, I will again say "Welcome" to this convention, and I trust that next year you will return and be our guests again.

President Beggs:— Your honor, in behalf of the association I desire to thank you for your courtesy in coming before us this morning and for these cordial words of welcome.

The next order of business is the address by the president, and prefacing that, I would say that I have not had time at my command to prepare what might be termed a formal address. It is something I seldom do. I have, however, jotted down a few suggestions and have some memoranda of thoughts which have occurred to me at various times during the convention.

## ADDRESS OF THE PRESIDENT.

*Gentlemen of the Convention and Members of the Affiliated Associations:*

I sincerely hope that you may all find Atlantic City what your officers and executive committee intended and expected it would be to you, one of the most enjoyable and suitable places in which we have ever met. Very careful and exhaustive investigation was given to the subject of a proper place at which to hold this year's convention. We finally selected Atlantic City because of its ample and magnificent hotel accommodations and the admirable provision made for our exhibits, there being but few cities in the country which have sufficient space of suitable character in which to house the latter. This matter is becoming of more importance, year by year, and suggests the thought to many of those who are charged with the responsibility of the administration of your association, as to the necessity of locating at some one city where ample hotel accommodations and suitable space for exhibits are available.

Since our last annual convention your officers and executive committee have obtained commodious and admirably adapted permanent offices for the association in the new Engineering Societies building at No. 29 West Thirty-ninth street, New York. This change subjects the association to considerably increased rental but it was absolutely necessary to have larger and better adapted offices for the secretary and treasurer and for the statistical library, in order to carry on the work of the association on the broader lines contemplated for it by the adoption of our new constitution and the perfection of the affiliated associations.

During the year the secretary and treasurer has more than maintained the record made during the preceding year, in the amount and value of the work turned out of his office, and it is with great pleasure that I bear testimony to his untiring energy and efficiency. From the statistics gathered in the secretary's office he has been enabled, during the year, to render valuable service to a number of companies holding membership in our association. That these services have been of great value and highly appreciated is evidenced by the fact that one of the companies to whom this service was rendered sent to the secretary a check for a substantial amount in recognition of his work. This check the secretary voluntarily and properly returned to the company. This prompts me to suggest that, in cases where the companies feel that the service they have obtained from the office of the association is of such great value to them, it would not be amiss for them to make a contribution direct to the association, to be used in enlarging the scope of its work, as your officers have been constrained to keep expenses down as much as possible, notwithstanding they recognize that additional help could be employed with great advantage. I hope that the finances of the association will justify the incoming officers and executive committee during the ensuing year in authorizing the additional expenditure necessary.

At this time I desire to repeat a suggestion which I made at the meeting of the executive committee of your association yesterday afternoon, and I give it now in order that it may be brought before the affiliated associations. I believe that additional effectiveness could be given to the office of the secretary and treasurer at a minimum of cost if the positions of working secretaries of the several affiliated associations were placed in the office of the secretary and treasurer of the American Association, and the office of secretary of these affiliated associations were made honorary. This would enable a statistician and additional clerical force to be employed in the permanent office of the association, this work being done by one of the assistants of Professor Swenson.

A large part of the work of these associations is now done in the office of the secretary of the American Association, the greatest amount of labor being the preparation of the annual reports. This plan would permit of a larger corps of employes in the association office, and they need to be skilled; need to be trained in the gathering of statistics. It would also enable Professor Swenson to leave his office more frequently without feeling that the work of the association was suffering, to go to places where statistics are to be gathered or where his experience or evidence might be of value. This suggestion I commend to the serious consideration of the three affiliated associations.

It is gratifying to be able to report that, notwithstanding the increase in the dues, all of the large companies have continued their membership in the association, and that the total membership at the close of our fiscal year, September 30, 1907, was 227, as compared with 200 at the beginning of our fiscal year, October 1, 1906; and that, notwithstanding the expenses of the association increased during the year to the extent of $2,991.75, the balance at the beginning of the ensuing fiscal year, October 1, 1907, is $6,137.95, as against $6,976.90 twelve months previous. The associate membership in 1906 was 113; in 1907 it is 148, a gain of 35.

While upon that subject, in order that you may better comprehend the solicitude your officers feel respecting the necessity of administering the financial affairs of this association with care, I might state that the receipts of the association for the last fiscal year were $24,724.97, and that the expenses — kept down as they were — amounted to $25,563.72. This association should have dues coming in to an amount of from $30,000 to $35,000 per annum, in order to enable it to perform the work in the manner it should be done to the greatest advantage of the association, which means the advantage of its members. It is in line with making this amount of money go as far as possible that I suggest this consolidation of the salaried officers of the various affiliated associations It is in line with the consolidation of companies throughout the country, which has been going on for several years, to reduce expenses.

The presidents of those three affiliated associations are members of our executive committee, and they have been better consolidated under our new constitution than have the secretaries. As has been well said by one of your presidents, the present arrangement of having salaried secretaries for the affiliated associations was made because two years ago there was some doubt as to just how the new laws under which we were proposing to be governed would work out. We have two years' experience back of us now, and I think some of the apprehension, at least, on the part of those who were so deeply interested in the welfare of these affiliated associations, has possibly been set at rest.

It gives me pleasure to inform you that at a meeting of the executive committee held in New York on May 20th of this year, there were present five of the past presidents of the association. That fact has prompted me to suggest that there should be some official recognition given to the gentlemen who had filled these positions and performed the work of president, for no one has any idea of the amount of work there is to be done until he has passed through it. I have therefore suggested to the executive committee that the past presidents should be constituted honorary members of the executive committee, but without a vote therein, in order that the association may continue to avail itself of their experience as representative men in this business, and that they in turn may feel not only that they are permitted to attend the meetings of the executive committee of the association, but also that they have some duty to perform therein.

Passing from the business affairs of the association to those of the companies holding membership therein, it is to be earnestly regretted that we cannot report more favorable conditions existing between many of the companies and the communities in which they operate, owing in a large measure to the continued unreasonable, vindictive and demagogic attitude of many of the public officials and politicians in the various localities where our companies operate.

No consideration appears to be given the fact that, while many elements entering into the operation and maintenance of electric railways have greatly increased in cost, we cannot increase the charges for the service rendered. In many cases unjustifiable and unreasonable demands are made for reductions in charges for the service rendered, notwithstanding the amount possible to be earned upon the capital invested does not exceed, and in many instances does not equal, the amount that could be realized on investments in mortgages or other classes of property not subject to the risks incident to investment in public utilities.

This has become so marked I venture the prediction that until a very radical change is worked in the minds of the general public it will be almost impossible to obtain additional capital to make the extensions and additions necessary to give to the cities and towns the transportation facilities their increasing growth and the demand for better equipment and service constantly render necessary. And this condition is, in my opinion, likely to continue until the several states provide for the creation and appointment of commissions with power to intelligently and impartially investigate and regulate the conditions of operation and the charges to be made by public service corporations, and remove them from the exploitation of local politicians, whose principal business is generally to play to the galleries, by attacking every thing done by a public utility corporation, whether right or wrong, and setting themselves up as being better qualified to administer and operate these corporations with their complex and laborious requirements, than those who have spent their lives in acquiring the technical and business skill and experience necessary to successfully administer this class of properties.

I venture the statement that there is no calling or profession in the world so difficult to fill successfully and with credit as that of administering the means of transportation in our large cities, be they surface, overhead or underground railways, where several hundreds of thousands, and in some cases millions, of people must be handled daily, and the bulk of them within quite a limited time, during the hours of congestion in the morning and evening. And instead of receiving the hearty and intelligent cooperation of public officials to enable this service to be well performed, the corporations are frequently handicapped by unreasonable and impracticable regulations and the failure to enact legislation and ordinances which would properly regulate traffic on the streets of the towns and cities and enable the public to be transported more safely and speedily. It is impossible in many cities to obtain any effective remedy against obstinate teamsters who may obstruct the streets and unnecessarily delay thousands of passengers on street cars, simply because the teamster may belong to some organization of which the local politicians are in dread.

The magnitude of the business of the street, suburban and interurban electric railways of the country may be judged by the fact that at the close of the year 1906 the total capital liabilities of these companies in the United States amounted to $3,765,317,875, being an increase of practically $400,000,000 during the year 1906. The total mileage of these roads at the close of 1906 was about 36,932, an increase of 3,782 miles during the year.

Since our last convention the development of single phase alternating equipment has made gratifying progress, greatly facilitating and rendering less expensive the construction of high speed electric interurban lines over outlying, sparsely settled territory, thereby rendering unnecessary the large investment required for substation and feeder construction for direct current transmission. There has likewise been gratifying progress made in the development of more efficient types of motors for direct current operation.

A matter of great importance and one which I do not think has been given that degree of attention which it merits by a large number of the companies of this association, is that relating to depreciation and amortization, and I feel that it is high time that the companies recognize the vital importance of this question and take means to set aside funds to provide for the continual wear that is going on and for which no provision is being made, as it is neither proper nor practicable to make good this wear by new issues of capital. Furthermore, companies having limited franchises should, in my judgment, make provisions for the repayment to the investors in the stocks and securities of these companies at the expiration of the franchises, and I have no doubt these matters will be brought home to many more of you within the next few years as they are to some of us at the present time.

I commenced nearly eleven years ago setting aside monthly a fixed amount of the gross receipts of one of our large companies — after charging to operation and maintenance the current repairs and renewals — out of which has been paid extraordinary replacements and renewals. Notwithstanding we entered into a contract with the city nearly eight years ago whereby many concessions were made by the corporation to the city, in consideration of a few years extension of the franchise, among which were the sale of 25 tickets for $1.00 or 6 for 25 cents, the granting of transfers, the free transportation of policemen and firemen and other concessions, the city council some months ago instructed the city attorney to institute proceedings to bring about a further reduction of our fare to 3 cents. In pursuance of this instruction the city attorney employed a firm of well known accountants to make an exhaustive examination of our books for a period of ten years from January 1, 1897 to December 31, 1906. On this work a large force of expert accountants were kept for several months and have presented to the city authorities possibly the most exhaustive report that has ever been made upon a street railway company in this country. Among other things they say: "We found the books and records of the company to have been kept with unusual skill and accuracy and we were accorded at the hands of the company every courtesy which would facilitate our work and we are pleased to give here an expression of our appreciation of the consideration shown us. The attitude of the management in this respect is creditable, in view of the fact that our visitation was not at the instance of the company nor was our work presumed to be for its benefit."

They further stated that: "It is proper at this point in our report to observe that from the standpoint of the stockholder the books disclose results which mark the management of this company as being of uncommon capacity. From the same standpoint there is little to be desired since, in addition to the payment of good dividends, the property has been so well kept up that it probably is in better condition at the end of each year than ever before, while ample reserves have been accumulated with which to meet every contingency which may reasonably be expected to arise in the conduct of the business. The standpoint from which we view the matter, however, is essentially different from that of the stockholder, since the interest of the public, represented in this inquiry by the city government, is not necessarily conserved by large returns to the stockholders but is centered in the question of how cheaply may good service be given."

These expert accountants, acting for the city, and looking at the matter purely from an accounting point of view, and having no experience as to the operation of electric railways, take the position that we are not justified in creating the reserve funds which I know are absolutely necessary to properly maintain and keep up the property and to provide for the demands which are inseparable from the proper administration of this character of properties. Applying careful and close management, which the accountants denominate as of "uncommon capacity," and because of a familiarity with the fire insurance business, I felt that it was good policy to charge a small percentage — one per cent.— of our gross receipts monthly to operation and carry it to a "Fire Insurance Reserve" fund, out of which all fire insurance premiums and losses not covered by insurance, have been paid, the balance being invested in interest bearing securities, with the result that at the present time we have in this fund $450,000 of first class 5 per cent. bonds — interest on which is likewise credited to the fund. It is unnecessary to state to you gentlemen who are experienced in placing fire insurance on these properties, how much influence the fact that we have this invested fund has upon the rate we are accorded by the old line fire insurance companies. This charge against operation the expert accountants think was unnecessary, and propose to credit it back to net earnings. They likewise attack and propose to carry back to net earnings an amount of $350,000 we have invested in first class 5 per cent. bonds to the credit of "Injuries and Damages Reserve Fund," this fund having been accumulated out of a maximum charge of 4 per cent. of our gross receipts. For several years of my operation of the property the amount charged against operation and carried to the credit of "Injuries and Damages Reserve," was only 3 per cent. This amount it is likewise argued by the accountants should be credited to net earnings, all for the purpose of showing that the company might have been operated for so much less money as to have permitted a fair dividend to have been paid upon the capital of the company and yet a lower rate of fare granted.

The absurdity of this will be evident to any manager of a large company who knows how long it would require to settle up and the amount of money necessary to pay for the injuries and damages that are hanging over these large companies and which could not, under any circumstances, be settled in any reasonable manner in a less period than from five to seven years. I have claimed that our companies should be so administered that if they were to go into liquidation at any time, they would have a fund created from month to month, as accidents occur, which would pay approximately all amounts that might be required to discharge all claims pending against them for injuries or damages, either to person or property. I feel very sure that when these matters are properly presented to a court of equity, the position of the company will be maintained, and if the expert accountants should be present, they will acquire some knowledge and experience that cannot be obtained in an accounting office by simply computing columns of figures. This I say with all due respect to the profession of public accountants.

I commend to your consideration the advisability of revising, to some extent, the schedule of dues as provided for in the constitution adopted two years ago. Some of the larger companies feel that the amount they are called upon to pay is out of proportion to the value they receive as compared to the advantages of the association to the smaller companies. This is a matter worthy of your most careful consideration as it now requires approximately $25,000 per annum to meet all the requirements of the association and a larger amount could be expended with advantage to the member companies.

To the officers and executive committee, and likewise to the standing committees and to the past presidents of the association, I hereby tender my hearty acknowledgment and thanks for their zeal and attention to the business and interests of the association during the past year, and I bespeak for the incoming officers and committees equally enthusiastic, loyal and self-sacrificing service, for there never was a time when it was more necessary to stand shoulder to shoulder in protecting and advancing the interests and welfare of this great industry than at the present time.

President Beggs:—You will find upon the seats printed copies of the annual report of the executive committee covering the meetings held during the past year, except the one of yesterday, the minutes of which will be read presently. You will likewise find distributed the annual report of the secretary and treasurer, which will give you in detail the figures which I have used in these remarks. These reports have been printed in order that you may have the full information before you and be enabled to discuss these matters as they come before the association.

The next order of business is the annual report of the executive committee. The minutes of the meeting of yesterday I will now read, as the secretary has been having trouble with his eyes recently and is not able to read.

## ANNUAL REPORT OF THE EXECUTIVE COMMITTEE

### MEETING OF THE EXECUTIVE COMMITTEE, HELD AT THE FAIR GROUNDS, COLUMBUS, OHIO, FRIDAY, OCTOBER 19, 1906.

The meeting was called to order at 3 P. M., President Beggs in the Chair.

Those present were: John I. Beggs, president; James F. Shaw, second vice president; C. L. S. Tingley and H. H. Adams (representing the Accountants' Association and the Engineering Association, respectively) and B. V. Swenson, secretary and treasurer.

On motion of Mr. Adams, Bernard V. Swenson was reappointed to the office of secretary and treasurer of the association.

On motion of Mr. Adams, the matter of obtaining additional quarters, or changing the present location of the permanent office of the secretary and treasurer, was placed in the hands of the president, the second vice president and the secretary-treasurer, with power to act.

On motion of Mr. Shaw, the secretary was authorized to appoint and fix the compensation of the office assistants, after consultation with and the approval of the president of the association.

On motion of Mr. Shaw, the secretary was authorized to make the necessary change in Article VI, Section c, of the By-Laws, to make the same read "American Street and Interurban Railway *Manufacturers'* Association."

On motion of Mr. Tingley, the technical press was given permission to publish the papers read at the Columbus convention on "Handling Public Complaints," by Mr. John A. Beeler, general manager of the Denver City Tramway Company, Denver, and "Leaks Between Passenger and Treasurer," by Mr. A. H. Stanley, general superintendent of the Public Service Corporation of New Jersey, Newark, N. J.

On motion of Mr. Shaw, the secretary was instructed to publish in pamphlet form the address made by the Hon. H. J. Booth at the annual banquet and to send this pamphlet to all the members and associate members.

On motion of Mr. Shaw, it was decided that the banquet speeches be not included in the Annual Report, but filed in the office of the association.

On motion of Mr. Tingley, it was decided to include the reports of the Committees on Municipal Ownership (Mr. C. D. Wyman, chairman), and Public Relations (Mr. John B. Parsons, chairman), in the printed proceedings of the convention, subject to the supervision of the president; these reports not to be published in any form before they appear in the annual proceedings.

On motion, duly seconded, the meeting adjourned.

Respectfully submitted,

(Signed) B. V. SWENSON,
*Secretary.*

MINUTES OF THE MEETING OF THE EXECUTIVE COMMITTEE HELD AT THE ASSOCIATION HEADQUARTERS, 60 WALL STREET, MONDAY, JANUARY 28, 1907.

The meeting was called to order at 10:05 A. M., President John I. Beggs, of Milwaukee, in the Chair.

Those present were: The President, John I. Beggs; Second Vice President, James F. Shaw; Third Vice President, Arthur W. Brady, and Messrs. C. L. S. Tingley, representing the Accountants' Association; H. H. Adams, representing the Engineering Association; S. L. Rhoades, representing the Claim Agents' Association, and B. V. Swenson, Secretary and Treasurer.

There were also present, representing the American Street and Interurban Railway Manufacturers' Association: James H. McGraw, H. C. Evans, H. F. Martin and E. M. Williams.

Mr. H. H. Vreeland, president of the New York City Railway Company, was also present during the latter part of the session.

Messrs. H. W. Blake, representing the Street Railway Journal, and Hugh M. Wilson, representing the Electric Railway Review, were also present.

The secretary stated that the first vice president, Calvin G. Goodrich, of Minneapolis, was in the South and unable to be present. He also stated that Hon. W. Caryl Ely had expected to be present, but had been called to Buffalo.

The minutes of the meeting of the executive committee, held at Columbus just after the Columbus convention, were read and approved.

The secretary then read a general statement concerning the affairs of the association. Among the matters considered in this connection were the questions of membership, annual dues for 1907, estimated total revenue for 1907, status of the Annual Reports of the 1907 convention, and the new offices of the association in the Engineering Societies building, 29 West Thirty-ninth street. A copy of this communication is on file in the secretary's office.

The principal matters considered by the committee were the location and plans for the 1907 convention, the appointment of special and standing committees, the removal of the office of the association from 60 Wall street to the Engineering Societies building, the annual dues for 1907, the estimated total revenue for 1907, membership, printing of the discussion on Depreciation in the Accountants' Association Report, and the printing of the Reports of the Committees on Municipal Ownership and Public Relations and the Reports of the American Association.

On motion, the action of the special committee, appointed to secure quarters in the Engineering Societies building, was approved. A very considerable discussion then occurred concerning the 1907 convention. The secretary read invitations from various places among which were Boston, Chicago, Atlantic City and

Jamestown. The general concensus of opinion was that the convention should be held in the East and preferably on the Atlantic seaboard. Representatives from the Jamestown Exposition and the city of Norfolk were present to urge the desirability of holding the convention either at the Exposition or in the city. Representatives of Atlantic City were also present and urged the desirability of that place for the convention. A committee was appointed with instructions to carefully consider these various places, in conjunction with a similar committee from the Manufacturers' Association, and to take final action in the matter. This committee is composed of Vice President Shaw as Chairman, Mr. Tingley, President of the Accountants' Association and Secretary Swenson, with President Beggs as a member ex-officio.

An adjournment was then taken until 2 p. m. The afternoon session was called to order at 2:15 o'clock.

The discussion of convention matters was continued at the afternoon session and the committee next proceeded to the consideration of the financial status of the association. After a considerable discussion, it was decided by vote of the committee that an appropriation of $1,500 be made the Accountants' and Engineering Associations and an appropriation of $900 to the Claim Agents' Association for expenses during the current year.

A discussion followed on matters connected with membership in the association and the work of the membership committee in obtaining new members. Mr. H. H. Vreeland, chairman of the membership committee, was present and took part in this discussion.

The secretary announced that the following street railway companies had applied for membership in the association since the meeting of the executive committee, held October 19, 1906:

Galesburg & Kewanee Electric Railway Company.
Scioto Valley Traction Company.
South-Western Traction Company.
Jackson Consolidated Traction Company.
Owosso & Corunna Electric Company.
Roanoke Railway and Electric Company.
The Aurora, Elgin & Chicago Railroad Company.

The secretary then presented the following list of associate members who had applied for admission since the meeting of the executive committee on October 19, 1906:

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| Charles A. Alden | Steelton, Pa. |
| Paul Cook | Troy, N. Y. |
| H. L. Libby | Boston, Mass. |
| E. J. Wilcoxen | Rochester, N. Y. |
| J. M. Yount | Pittsburg, Pa. |
| Charles E. Warner | Rockingham, N. C. |
| W. Worth Bean | Benton Harbor, Mich. |

On motion the above named companies and associate members were admitted to membership.

The president was authorized to appoint a special committee to confer with a similar committee from the National Fire Protection Association to the end that a set of rules and regulations be formulated governing modern carhouse construction.

On motion it was decided that the discussion on Depreciation at the 1906 Accountants' Association convention be published in the proceedings of that association.

On motion it was decided that the Reports of the Committees on Public Relations and Municipal Ownership, submitted at the 1906 convention of the American Association, be published in the Proceedings of the American Association.

On motion the meeting adjourned.

Respectfully submitted,
(Signed) B. V. SWENSON,
*Secretary.*

## MEETING OF THE EXECUTIVE COMMITTEE HELD AT ASSOCIATION HEADQUARTERS, UNITED ENGINEERING BUILDING, 29 WEST THIRTY-NINTH STREET, NEW YORK CITY, MONDAY, MAY 20, 1907.

The meeting was called to order at 2 P. M., President Beggs in the Chair.

There were present John I. Beggs, President; James F. Shaw, second vice president; Arthur W. Brady, third vice president; C. L. S. Tingley, of the Accountants' Association, H. H. Adams, of the Engineering Association, and B. V. Swenson, secretary and treasurer.

The following named past presidents of the association were also present: Messrs. Joel Hurt, H. M. Littell, Albion E. Lang, Charles S. Sergeant and J. C. Hutchins. Two other past presidents of the association, Mr. H. H. Vreeland and Hon. W. Caryl Ely, fully expected to be present at this meeting, but were prevented by important business at the last moment. Mr. W. B. Brockway, past president of the Accountants' Association, was also present just before adjournment of the meeting.

The minutes of the meeting of January 28, 1907, were read and approved.

The secretary announced that the following named companies had applied for active membership since the meeting of the executive committee held on January 28th:

Mason City & Clear Lake Railway Company.
Athens Electric Railway Company.
Iowa & Illinois Railway Company.

On motion, duly seconded, these companies were admitted to active membership.

The secretary announced that the following named individuals had applied for associate membership since the meeting of the executive committee held on January 28th:

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| Sidney W. Ashe | Brooklyn, N. Y. |
| George C. Shaad | Boston, Mass. |
| P. N. Jones | Pittsburg, Pa. |
| I. De Young Shipper | Philadelphia, Pa. |
| E. Sakuma | Tokio, Japan. |
| C. S. S. Miller | New York, N. Y. |
| Westinghouse, Church, Kerr & Co. | New York, N. Y. |
| Walter C. Kerr | New York, N. Y. |
| Sidney E. Junkins | New York, N. Y. |
| Henry R. Kent | New York, N. Y. |
| Carl M. Vail | New York, N. Y. |

On motion, duly seconded, these individuals were admitted to associate membership.

The secretary presented a report in which was considered a number of matters relating to the association work, such as active and associate membership, annual dues, finances, status of 1906 proceedings, binding of reports of the American Street Railway Association, 1907 convention, new offices, office force, committee work, etc.

As chairman of the special committee on selection of association headquarters, President Beggs made an informal report concerning the new offices in the United Engineering building, 29 West Thirty-ninth street, New York City. He stated that it was essential to the work of the association that more room be provided than was contained in the office at 60 Wall street and that the present headquarters not only contained more floor space than could be had for the same rental in the down-town district, but that these offices were very much more desirable from the standpoint of the work of the association.

On motion, duly seconded, the action of the special committee appointed for the purpose of selecting offices in the United Engineering building was duly approved.

President Beggs, as chairman of the committee to decide upon the date and place for holding the 1907 convention, reported that the committee, consisting of John I. Beggs, chairman, James F. Shaw, C. L. S. Tingley and the secretary, had visited Norfolk and Atlantic City in March, in conjunction with a similar committee from the American Street & Interurban Railway Manufacturers' Association and that it was the consensus of opinion that the 1907 convention should be held in Atlantic City on October 14th to 18th inclusive. He further stated that invitations had been received from Boston, Chicago, Washington and other places, but that for one reason or another, it was quite impracticable to hold the convention in any of these cities this year.

On motion of Mr. Brady, the action of the committee in selecting Atlantic City as the place and October 14th to 18th as the time for holding the 1907 convention was duly approved.

President Beggs expressed his gratification and that of the other members of the executive committee in having so many of the past presidents in attendance at the meeting. In the course of his remarks on this subject, he stated that it was highly desirable from all standpoints that the past officers should actively participate in the work of the association whenever possible. The president further stated that in his opinion the past presidents should, each in order, be presented with a handsome badge, upon which there would be room for a bar containing the words "Past Presidents."

Mr. Richard McCulloch, chairman of the committee on subjects, presented a report from that committee, the essential features of which were as follows:

That the morning of Monday, October 14th, be reserved for registration and the issuing of badges.

That the Engineering and Claim Agents' Associations hold sessions Monday afternoon, Tuesday morning, Tuesday afternoon and Wednesday morning.

That the Accountants' Association hold sessions Tuesday morning, Tuesday afternoon, Wednesday morning and Thursday morning.

That the American Association hold its opening meeting on Wednesday afternoon, and that the various affiliated associations join in this meeting.

The committee also recommended that there be five sessions of the American Association convention, the other four being on Thursday morning, Thursday afternoon, Friday morning and Friday afternoon.

Mr. McCulloch, chairman of the American Association committee on subjects, also presented a report outlining the papers and committee reports to be presented at the various sessions of the American Association convention.

Considerable discussion ensued as to the desirability of having but one American Association session each day and it was finally decided that the American Association should hold three sessions as follows:

Wednesday, October 16th, 9:30 a. m. to 1 p. m.
Thursday, October 17th, 9:30 a. m. to 1 p. m.
Friday, October 18th, 9:30 a. m. to 1 p. m.

It was then decided that the Engineering and Claim Agents' Associations should each hold four sessions, as follows:

Monday afternoon, Tuesday morning, Tuesday afternoon and Wednesday afternoon. It was also decided that the Accountants' Association would hold four sessions as follows:

Tuesday morning, Tuesday afternoon, Wednesday afternoon and Thursday morning.

There then occurred a considerable discussion concerning the desirability of closing the exhibits of the Manufacturers' Association during the sessions of the American Association convention, and of having a roll call at the convention meetings of all associations.

The president stated that the Manufacturers' Association had agreed to close the exhibits during the hours of meeting of the American Association.

It was finally decided to have a roll call at each of these sessions and that a copy of the roll be sent to the various companies. This action was taken on motion of Mr. Brady, duly seconded and carried.

Mr. McCulloch, chairman of the committee on subjects, then presented a revised report of the committee, showing the rearrangement of the program of the American Association which was practically as that finally carried out at the convention.

On motion, the various papers and committee reports suggested for the American Association convention were approved.

The question of having an annual banquet was discussed at some considerable length and it was finally decided to refer this matter for action, to the executive committee, at a later date.

A full stenographic record of the minutes of this meeting is on file in the secretary's office.

On motion, the meeting adjourned.

Respectfully submitted,
(Signed) B. V. SWENSON,
*Secretary.*

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MINUTES OF THE MEETING OF THE EXECUTIVE COMMITTEE, HELD AT THE MARLBOROUGH-BLENHEIM HOTEL, ATLANTIC CITY, N. J., TUESDAY, OCTOBER 15, 1907.

The meeting was called to order at 4:30 o'clock, President Beggs in the Chair.

There were present: John I. Beggs, president; C. G. Goodrich, first vice president; Arthur W. Brady, third vice president; C. L. S. Tingley, president of the Accountants' Association; H. H. Adams, president of the Engineering Association; Henry C. Bradley, acting president of the Claim Agents' Association, and B. V. Swenson, secretary and treasurer.

Mr. W. Caryl Ely, past president of the association, was also present during the latter part of the meeting.

The minutes of the meeting of the committee held on May 20, 1907, at the association headquarters, New York City, were read and approved.

The report of the secretary-treasurer for the fiscal year ending October 1, 1907, was then presented.

There then followed a general discussion on the details of the report, and it was finally approved as presented, to be read at the meeting of the association.

There was then a general discussion on the affairs of the association. President Beggs pointed out the necessity for a larger office staff, and as a means to secure the revenue with which to provide such a staff he suggested that the office of secretary of each of the affiliated associations should be made an honorary office and that all the clerical work in connection with the affiliated associations should be performed in the office of the American Association. He also advocated the employment of a competent statistician to assist the secretary in gathering information relative to the work of the association and to aid in the carrying on of any investigations which might be desirable in the interests of the member companies. President Beggs laid particular emphasis on the fact that the members should be encouraged in every possible way to make the office of the association a clearing house in the dissemination of every possible form of information which they migh desire relating to the street railway business.

The question of revising the present scale of dues was discussed at some length, and the opinion was expressed that the scale of dues for the small companies was too small; that these companies were really getting the greatest benefit from the work of the association, and that some of the large companies were inclined to consider $600 as too large a sum for membership.

In view of the present financial condition of the country, the committee decided that it would be unwise to disturb the scale of dues at this time.

The president and other members of the committee spoke at some length upon the subject of the desirability of maintaining the interest of the past presidents in the association work. It was felt by all that their influence and experience must necessarily be of great value to the association, and that efforts should be made to secure their active cooperation in the work of the association at all times.

As a result of this discussion, the following resolution was passed:

*Resolved,* that the executive committee recommend to the association that paragraph (a) of article (VI) of the by-laws of the American Street and Interurban Railway Association be amended to read as follows:

"The entire charge and management of the affairs of the association shall be in the hands of an executive committee, which shall consist of the president, the vice presidents and one member appointed by each of the affiliated associations, and all the past presidents of the American Street and Interurban Railway Association and its predecessor, the American Street Railway Association, these past presidents to be honorary members of the executive committee, but without the power to vote at meetings of the committee. The executive committee shall make arrangements for carrying out the objects of the association."

It was also voted that all past presidents be given a special invitation to be present at all meetings of the executive committee and of the association and that they be provided with special badges with the words "Past President" thereon.

The question as to what disposition should be made of the test car "Louisiana" was then considered by the committee. Mr. Ely stated that the test car was accepted by the American Street Railway Association upon the distinct understanding that the Electric Railway Test Commission was to turn over this car to that association complete in all its component parts, and that the car was to be housed and cared for by Purdue University without expense to the association or to its successor, the American Street and Interurban Railway Association.

The secretary reported that up to the present time the car had not been made complete and that both the manufacturing interests which supplied the component parts and the officials of Purdue University desired that some disposition be made of this matter at an early date.

On motion of Mr. Goodrich, seconded by Mr. Bradley, the secretary was directed to inform the secretary of the Electric Railway Test Commission that inasmuch as the commission has not secured up to the present time the permanent loan of all apparatus and equipment forming the component parts of the test car "Louisiana," the American Street and Interurban Railway Association considers that it is no longer obligated to accept the test car "Louisiana" from the Electric Railway Test Commission according to the agreement made by the executive committee of the American Street Railway Association at the meeting of the executive committee held in February, 1905.

President Beggs brought up the proposition which had been made by Mr. Bell, representing the Hotel Men's Association of Atlantic City, to make Atlantic City the permanent meeting place of the association and to construct a new pier with all possible facilities and accommodations for the holding of the exhibition of street railway appliances.

No action was taken on this matter and it was decided to bring the proposition before the convention.

On motion, the meeting adjourned.

Respectfully submitted,
B. V. Swenson,
*Secretary.*

## *Discussion of the Annual Report of the Executive Committee.*

President Beggs:— I might state now what I omitted to say in my former remarks, which is that I recommend very strongly that this same action be taken in the affiliated associations, namely, that the past presidents of each of those associations should be honorary members of their executive committees, in order that they may be called upon whenever required. I also suggested that there should be special badges provided for the past presidents, which would distinguish them from the acting officers.

Mr. Harrington:— What steps are necessary in order to carry out the suggestion made by the executive committee as to the placing of the past presidents on that committee as honorary members?

President Beggs:— It would be necessary to make an amendment to the by-laws, and I understand that such an amendment will be presented later in this session, under the order of new business.

(On motion, duly seconded, the report of the executive committee was approved and ordered to be printed in the annual proceedings of the association.)

President Beggs:— The next order of business is the annual report of the secretary and treasurer. As this report is in printed form and has been distributed, a motion to dispense with the reading of the report will be in order.

(On motion, duly seconded, it was voted to dispense with the reading of the report of the secretary-treasurer.)

## ANNUAL REPORT OF THE SECRETARY-TREASURER FOR THE YEAR ENDING SEPTEMBER 30, 1907.

*To the American Street & Interurban Railway Association:*

Gentlemen.— In presenting this, the second annual report of the secretary-treasurer since the reorganization of the association, it has seemed wise to make a somewhat detailed report showing the exact status of the membership and to follow this with the financial report, including the certificate showing the bank balance and the statement made by the expert accountant who audited the books of the association.

Associate Members who Have Paid 1906-7 Dues Before October 1, 1907:

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| H. H. Adams | Baltimore, Md. |
| Charles A. Alden | Steelton, Pa. |
| George O. Anderson | East Liverpool, Ohio. |
| Sydney W. Ashe | Brooklyn, N. Y. |
| W. Worth Bean | Chicago, Ill. |
| Edwin H. Baker | New York City. |
| John G. Baukat | White Plains, N. Y |
| Thomas K. Bell | Philadelphia, Pa. |

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| Charles H. Bigelow | Dallas, Texas. |
| A. W. K. Billings | Havana, Cuba. |
| Henry W. Blake | New York City. |
| John Boden | Milwaukee, Wis. |
| F. F. Bodler | San Francisco, Cal. |
| William C. Boyd | Pittsburg, Pa. |
| Daniel M. Brady | New York City. |
| F. M. Brinckerhoff | New York City. |
| H. M. Brinckerhoff | New York City. |
| B. I. Budd | Chicago, Ill. |
| Fred N. Bushnell | Boston, Mass. |
| F. C. Caldwell | Columbus, Ohio. |
| P. J. Callaghan | Pittsburg, Pa. |
| D. F. Carver | Wheaton, Ill. |
| Oral M. Chinn | Mt. Vernon, Ohio. |
| Harold W. Clapp | New York City. |
| Chas. S. Clark | Boston, Mass. |
| S. Waldo Coleman | Petaluma, Cal. |
| Barron G. Collier | New York City. |
| R. W. Conant | Aurora, Ill. |
| Paul Cook | Troy, N. Y. |
| John W. Corning | Boston, Mass. |
| L. P. Crecelius | Newark, N. J. |
| T. E. Crossman | Brooklyn, N. Y. |
| H. C. Daggett | Salisbury, N. C. |
| R. E. Danforth | Newark, N. J. |
| Francis H. Dewey | Worcester, Mass. |
| William A. Dibbs | New York City. |
| R. R. Dorland | Ogden, Utah. |
| E. P. Doyle | Wheaton, Ill. |
| J. S. Doyle | New York City. |
| James A. Duffy | Pittsburg, Pa. |
| Hon. W. Caryl Ely | Buffalo, N. Y. |
| Van Horn Ely | East Liverpool, Ohio. |
| W. H. Evans | Indianapolis, Ind. |
| C. B. Fairchild, Jr | Cleveland, Ohio. |
| M. J. Feron | Chicago, Ill. |
| Henry A. Fiske | Hartford, Conn. |
| Harvey B. Fleming | Chicago, Ill. |
| E. E. Franklin | Salt Lake City, Utah. |
| Fred H. Froehlich | Toledo, Ohio. |
| W. H. Gardiner, Jr | New York City. |
| Robert S. Goff | Boston, Mass. |
| E. S. Goodrich | Hartford, Conn. |
| L. E. Gould | Chicago, Ill. |
| Alfred Green | Brooklyn, N. Y. |
| W. M. Greenwood | New York City. |

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| Merle R. Griffeth | St. Louis, Mo. |
| Frederic D. Hall | Boston, Mass. |
| J. W. Harper | Washington, D. C. |
| Thomas Hawkens | Rockland, Me. |
| Hugh Hazleton | New York City. |
| Charles T. Herrick | Williamsport, Pa. |
| James Heywood | Philadelphia, Pa. |
| Wm. E. Humphreys | Denver, Colo. |
| D. C. Jackson | Boston, Mass. |
| D. C. & W. B. Jackson | Madison, Wis. |
| P. N. Jones | Pittsburg, Pa. |
| W. J. Jones | Austin, Texas. |
| P. Jungersfeld | Chicago, Ill. |
| Sydney E. Junkins | New York City. |
| R. F. Kelker | Brooklyn, N. Y. |
| G. H. Kelsay | Anderson, Ind. |
| Henry P. Kent | New York City. |
| Walter C. Kerr | New York City. |
| G. C. Killeen | Trenton, N. J. |
| Geo. A. Kimball | Boston, Mass. |
| J. M. King | Danville, Va. |
| John F. Knowlen | New Decatur, Ala. |
| A. R. Lambe | Toronto, Ont. |
| J. M. Larned | Pittsburg, Pa. |
| E. B. Latta, Jr | Charlotte, N. C. |
| George Lawson | Schenectady, N. Y. |
| Hudson F. Layton | Pittsburg, Pa. |
| E. Sidney Lewis | Philadelphia, Pa. |
| H. L. Libby | Boston, Mass. |
| F. H. Lincoln | Philadelphia, Pa. |
| John Lindall | Boston, Mass. |
| Norman Litchfield | New York City. |
| Bruce E. Loomis | New York City. |
| James H. McGraw | New York City. |
| J. C. McNally | Kenosha, Wis. |
| Geo. F. Madden | Toronto, Can. |
| C. O. Mailloux | New York City. |
| M. E. Major | Nanticoke, Pa. |
| F. D. Martin | Fort Scott, Kan. |
| Chauncey S. S. Miller | New York City. |
| F. Morrill | Washington, D. C. |
| S. W. Mower | London, Ont. |
| T. J. Mullen | New York City. |
| John Z. Murphy | Chicago, Ill. |
| H. B. Nichols | Philadelphia, Pa |
| A. A. Newman | Chicago, Ill. |
| Prof. Henry H. Norris | Ithaca, N. Y. |

| | |
|---|---|
| Hiland B. Noyes | Omaha, Neb. |
| Walter A. Pearson | Niagara Falls, Ont. |
| L. T. Peck | Honolulu, Hawaii. |
| G. E. Pellissier | New York City. |
| Chas. W. Petersen | Milwaukee, Wis. |
| Prof. Hylon T. Plumb | Lafayette, Ind. |
| E. E. Potter | New Bedford, Mass. |
| Chas. S. Powell | New York City. |
| John Powers | Sterling, Ill. |
| William A. Pratt | New York City. |
| W. Boardman Reed | New York City. |
| Albert S. Richey | Worcester, Mass. |
| E. P. Roberts | Cleveland, Ohio. |
| John A. Rogan | Pittsburg, Pa. |
| J. C. Rothery | East Liverpool, Ohio. |
| Daniel Royse | Chicago, Ill. |
| Eitaro Sakuma | Tokio, Japan. |
| H. S. Schreiber | Philadelphia, Pa. |
| Martin Schreiber | Newark, N. J. |
| Geo. C. Shaad | Boston, Mass. |
| James F. Shaw | Boston, Mass. |
| I. De Young Shipper | Philadelphia, Pa. |
| Fred G. Simmons | Milwaukee, Wis. |
| F. R. Slater | New York City. |
| Clement C. Smith | Milwaukee, Wis. |
| E. D. Smith | St. Louis, Mo. |
| G. J. Smith | Kansas City, Mo. |
| H. N. Sporborg | Rugby, Eng. |
| Theodore Stebbins | Cohasset, Mass. |
| F. C. Stieler | Pittsburg, Pa. |
| Bernard V. Swenson | New York City. |
| George B. Taylor | Philadelphia, Pa. |
| W. T. Taylor | Chihuahua, Mex. |
| J. E. Thielsen | Providence, R. I. |
| G. E. Tracy | Elyria, Ohio. |
| H. N. Twells | Philadelphia, Pa. |
| Carl M. Vail | New York City. |
| C. B. Voynow | Philadelphia, Pa. |
| H. Wallerstedt | New York City. |
| Charles E. Warner | Boston, Mass. |
| Westinghouse, Church, Kerr & Co. | New York City. |
| A. L. Whipple | New York City. |
| Hugh N. Wilson | Chicago, Ill. |
| Paul Winsor | Boston, Mass. |
| W. D. Wright | Providence, R. I. |
| J. F. H. Wyse | Toronto, Ont. |

Total — 148.

### Associate Members who Paid 1906 Dues Between October 1, 1906, and October 1, 1907.

| | |
|---|---|
| F. F. Bodler | San Francisco, Cal. |
| John W. Corning | Boston, Mass. |
| W. H. Evans | Indianapolis, Ind. |
| Charles T. Herrick | Williamsport, Pa. |
| H. L. Libby | Boston, Mass. |
| *E. T. Munger | Chicago, Ill. |
| H. S. Schreiber | Philadelphia, Pa. |
| *E. J. Wilcoxen | Rochester, N. Y. |
| *J. M. Yount | Pittsburg, Pa. |

Total — 9.

* 1907 dues unpaid up to October 1, 1907.

### 1905–1906 Associate Members who had not Paid 1906–1907 Dues Before October 1, 1907.

| | |
|---|---|
| C. F. Baker | Brooklyn, N. Y. |
| H. M. Beugler | Nashville, Tenn. |
| W. B. Brockway | Yonkers, N. Y. |
| G. W. Brubaker | Philadelphia, Pa. |
| Frank Buelow | Milwaukee, Wis. |
| A. D. Campbell | Seattle, Wash. |
| W. C. Canfield | Milwaukee, Wis. |
| C. L. Enfors | Fitchburg, Mass. |
| W. O. Fragmeier | Portland, Oregon. |
| Thomas F. Kelly | Spokane, Wash. |
| J. W. Kennedy | Milwaukee, Wis. |
| Edward McDonnell | East Liverpool, Ohio. |
| Ewin. W. Olds | Milwaukee, Wis. |
| Chas. C. Peirce | Boston, Mass. |
| S. L. Rhoades | Philadelphia, Pa. |
| J. E. Scobee | Portland, Oregon. |
| Edward P. Shaw | South Framingham, Mass. |
| M. H. Stumpf | Madison, Wis. |
| J. L. Sullivan | Farmington, Mo. |
| E. M. White | Birmingham, Ala. |

Total — 20.

### 1905–1906 Associate Members who Resigned Before October 1, 1907.

| | |
|---|---|
| D. L. Prendergast | Boston, Mass. |
| C. A. Smith | East Liverpool, Ohio. |

Total — 2.

### New Associate Members Admitted Before October 1, 1907.

| | |
|---|---|
| Charles A. Alden | Steelton, Pa. |
| Sydney W. Ashe | Brooklyn, N. Y. |
| W. Worth Bean | Chicago, Ill. |
| Thomas K. Bell | Philadelphia, Pa. |

| | |
|---|---|
| F. F. Bodler | San Francisco, Cal. |
| William C. Boyd | Pittsburg, Pa. |
| H. M. Brinckerhoff | New York City. |
| B. I. Budd | Chicago, Ill. |
| P. J. Callaghan | Pittsburg, Pa. |
| Oral M. Chinn | Mt. Vernon, Ohio. |
| Barron G. Collier | New York City. |
| R. W. Conant | Aurora, Ill. |
| Paul Cook | Troy, N. Y. |
| John W. Corning | Boston, Mass. |
| H. C. Daggett | Salisbury, N. C. |
| William A. Dibbs | New York City. |
| E. P. Doyle | Wheaton, Ill. |
| James A. Duffy | Pittsburg, Pa. |
| W. H. Evans | Indianapolis, Ind. |
| M. J. Feron | Chicago, Ill. |
| Henry A. Fiske | Hartford, Conn. |
| Fred H. Froelich | Toledo, Ohio. |
| E. S. Goodrich | Hartford, Conn. |
| L. E. Gould | Chicago, Ill. |
| Charles T. Herrick | Williamsport, Pa. |
| P. N. Jones | Pittsburg, Pa. |
| P. Jungersfeld | Chicago, Ill. |
| Sydney E. Junkins | New York City. |
| R. F. Kelker | Brooklyn, N. Y. |
| G. H. Kelsay | Anderson, Ind. |
| Henry P. Kent | New York City. |
| Walter C. Kerr | New York City. |
| John F. Knowlen | New Decatur, Ala. |
| A. R. Lambe | Toronto, Ont. |
| Hudson F. Layton | Pittsburg, Pa. |
| H. L. Libby | Boston, Mass. |
| Bruce E. Loomis | New York City. |
| J. C. McNally | Kenosha, Wis. |
| Geo. F. Madden | Toronto, Ont. |
| M. E. Major | Nanticoke, Pa. |
| F. D. Martin | Fort Scott, Kan. |
| Chauncey S. S. Miller | New York City. |
| A. A. Newman | Chicago, Ill. |
| Prof. Hylon T. Plumb | Lafayette, Ind. |
| John Powers | Sterling, Ill. |
| John A. Rogan | Pittsburg, Pa. |
| Eitaro Sakuma | Tokio, Japan. |
| H. S. Schreiber | Philadelphia, Pa. |
| Martin Schreiber | Newark, N. J. |
| Geo. C. Shaad | Boston, Mass. |
| I. De Young Shipper | Philadelphia, Pa. |

| | |
|---|---|
| G. E. Tracy | Elyria, Ohio. |
| Carl M. Vail | New York City. |
| Charles E. Warner | Boston, Mass. |
| Westinghouse, Church, Kerr & Co. | New York City. |
| A. L. Whipple | New York City. |
| J. F. H. Wyse | Toronto, Ont. |

Total — 57.

### SUMMARY OF ASSOCIATE MEMBERSHIP, OCTOBER 1, 1907.

| | | |
|---|---|---|
| Associate members, October 1, 1906 | | 113 |
| Resigned | 2 | |
| Dues unpaid | 20 | |
| | | 22 |
| Old associate members | | 91 |
| New associate members | | 57 |
| Total associate membership* | | 148 |

### NEW MEMBER COMPANIES ADMITTED BEFORE OCTOBER 1, 1907.

†Anderson Traction Co.
Athens Electric Railway Co.
Aurora, Elgin & Chicago Railroad Co.
Charlotte Electric Railway, Light & Power Co.
‡Chicago & Milwaukee Electric Railroad Co.
Columbus, Delaware & Marion Railway Co.
Columbus, New Albany & Johnstown Traction Co.
Dayton & Troy Electric Railway Co.
Dayton & Xenia Transit Co.
†Dayton, Covington & Piqua Traction Co.
Elgin & Belvidere Electric Co.
Evansville & Eastern Electric Railway Co.
Fort Wayne & Springfield Railway Co.
Galesburg & Kewanee Electric Railway Co.
Helena Light & Railway Co.
Indianapolis, Columbus & Southern Traction Co.
Inter-Urban Railway Co.
Iowa & Illinois Railway Co.
Jackson Consolidated Traction Co.
†Kennett & Coatesville Railroad Co.
Lima & Toledo Traction Co.
Mason City & Clear Lake Railway Co.

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* Mr. J. Russell Morse paid 1907–1908 dues before October 1, 1907. Not having paid 1906–1907 dues, his name will not appear as an associate member until after October 1, 1907.

† Paid admission fee but not 1907 dues.

‡ Joined in September, 1907, and 1907 dues remitted.

Nahant & Lynn Street Railway Co.
Northampton Traction Co.
Owosso & Corunna Electric Co.
Pacific Traction Co.
Pensacola Electric Co.
Roanoke Railway & Electric Co.
Raleigh Electric Co.
Richmond & Petersburg Electric Railway Co.
Scioto Valley Traction Co.
South-Western Traction Co.
Springfield Traction Co.
Toledo & Chicago Interurban Railway Co.
Trinidad Electric Railway Co.
*Wallkill Transit Co.
Winona Interurban Railway Co.
Total, 37.

| | |
|---|---|
| Total | 37 |
| 1907 dues unpaid | 4 |
| In good standing October 1, 1907 | 33 |

### NEW MEMBER COMPANIES WITH 1907 DUES UNPAID.

Anderson Traction Co.
Dayton, Covington & Piqua Traction Co.
Kennett & Coatesville Railroad Co.
Wallkill Transit Co.
Total, 4.

### ACTIVE MEMBERS IN GOOD STANDING, OCTOBER 1, 1907.

Altoona & Logan Valley Electric Railway Co.
Anniston Electric & Gas Co.
Asheville Electric Co.
†Athens Electric Railway Co.
Atlantic Coast Electric Railroad Co.
Atlantic Shore Line Railway Co.
†Aurora, Elgin & Chicago Railroad Co.
Austin Electric Railway Co.
Bangor Railway & Electric Co.
Bay City Traction Co.
Beaumont Traction Co.
Benton Harbor-St. Joe Railway & Light Co.
Binghamton Railway Co.
Birmingham Railway, Light & Power Co.
Boston & Maine Railroad Co. (Concord & Manchester Branch).

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* Paid admission fee but not 1907 dues.

† Indicates that the company became a member during the fiscal year ending September 30, 1907.

Boston & Northern Street Railway Co.
Boston & Worcester Street Railway Co.
Boston Elevated Railway Co.
Bridgeton & Millville Traction Co.
Brockton & Plymouth Street Railway Co.
Butte Electric Railway Co.
Calumet Electric Street Railway Co.
Camden Interstate Railway Co.
Capital Traction Co.
Cedar Rapids & Iowa City Railway & Light Co.
Central Pennsylvania Traction Co.
Charleston Consolidated Railway, Gas & Electric Co.
*Charlotte Electric Railway, Light & Power Co.
Chicago & Joliet Electric Railway Co.
Chicago City Railway Co.
Chicago Union Traction Co.
Chillicothe Electric Railroad, Light & Power Co.
Cincinnati Traction Co.
Citizens Electric Co.
Citizens Electric Street Railway Co.
Cleveland Electric Railway Co.
Cleveland, Painesville & Eastern Railway Co.
Cleveland, Southwestern & Columbus Railway Co.
Colorado Springs & Interurban Railway Co.
*Columbus, Delaware & Marion Railway Co.
*Columbus, New Albany & Johnstown Traction Co.
Columbus Railroad Co.
Columbus Railway & Light Co.
Concord, Maynard & Hudson Street Railway Co.
Consolidated Railway Co.
Consolidated Railways, Light & Power Co.
Dallas Consolidated Electric Street Railway Co.
Danbury & Bethel Street Railway Co.
*Dayton & Troy Electric Railway Co.
*Dayton & Xenia Transit Co.
DeKalb-Sycamore & Interurban Traction Co.
Denison & Sherman Railway Co.
Denver City Tramway Co.
Des Moines City Railway Co.
Detroit United Railway.
Duluth Street Railway Co.
East Liverpool Traction & Light Co.
East St. Louis & Suburban Railway Co.
Eastern Wisconsin Railway & Light Co.
*Elgin & Belvidere Electric Co.
Elmira Water, Light & Railroad Co.

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***Indicates that the company became a member during the fiscal year ending September 30, 1907.**

El Paso Electric Railway Co.
*Evansville & Eastern Electric Railway.
Farmington Street Railway Co.
Fairmont & Clarksburg Traction Co.
Fishkill Electric Railway Co.
Fitchburg & Leominster Street Railway Co.
Fonda, Johnstown & Gloversville Railroad Co.
*Fort Wayne & Springfield Railway Co.
Fort Wayne & Wabash Valley Traction Co.
Fries Manufacturing & Power Co.
*Galesburg & Kewanee Electric Railway.
Galveston Electric Co.
Gardiner, Westminster & Fitchburg Street Railway Co.
Georgia Railway & Electric Co.
Grand Rapids, Holland & Chicago Railway Co.
Grand Rapids Railway Co.
Great Falls Street Railway Co.
Groton & Stonington Street Railway Co.
Hartford & Springfield Street Railway Co.
*Helena Light & Railway Co.
Houghton County Street Railway Co.
Houston Electric Co.
Illinois Central Traction Co.
Indiana, Columbus & Eastern Traction Co.
Indiana Union Traction Co.
Indianapolis & Cincinnati Traction Co.
Indianapolis & Eastern Railway Co.
Indianapolis & Northwestern Traction Co.
*Indianapolis, Columbus & Southern Traction Co.
Indianapolis Traction & Terminal Co.
International Railway Co.
*Inter-Urban Railway Co.
*Iowa & Illinois Railway Co.
*Jackson Consolidated Traction Co.
Jackson Electric Railway, Light & Power Co.
Jacksonville Electric Co.
Kansas City Railway & Light Co.
Kingston Consolidated Railway Co.
Knoxville Railway & Light Co.
Kokomo, Marion & Western Traction Co.
Lake Shore Electric Railway Co.
Laredo Electric & Railway Co.
Las Vegas Railway & Power Co.
Lehigh Traction Co.
Lehigh Valley Transit Co.
Lexington Railway Co.

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* Indicates that the company became a member during the fiscal year ending September 30, 1907.

*Lima & Toledo Traction Co.
Little Rock Railway & Electric Co.
Long Island Consolidated Electrical Cos.
Louisville & Eastern Railroad Co.
Louisville & Southern Indiana Traction Co.
Louisville Railway Co.
Lynchburg Traction & Light Co.
Mahoning & Chenango Railway & Light Co.
Manila Electric Railroad & Light Co.
*Mason City & Clear Lake Railway Co.
Memphis Street Railway Co.
Menominee & Marinette Light & Traction Co.
Meridian Light & Railway Co.
Mexico Electric Tramways, Ltd.
Milford & Uxbridge Street Railway Co.
Millville Traction Co.
Milwaukee Electric Railway & Light Co., The
Mobile Light & Railroad Co.
Montreal Street Railway Co.
*Nahant & Lynn Street Railway Co.
Nashville Railway & Light Co.
New Hampshire Electric Railways.
New Jersey & Hudson River Railway & Ferry Co
New Orleans Railway & Light Co.
Newport News & Old Point Railway & Electric Co.
Newton & Boston Street Railway Co.
New York & Port Chester Railroad Co.
New York & Queens County Railway Co.
New York City Railway Co.
Norfolk & Portsmouth Traction Co.
*Northampton Traction Co.
Northern Ohio Traction & Light Co.
Northern Texas Traction Co.
Ohio River Electric Railway & Power Co.
Oklahoma City Railway Co.
Olympia Light & Power Co.
Omaha & Council Bluffs Street Railway Co.
Omaha, Lincoln & Beatrice Railway Co.
Ottawa Electric Railway Co.
*Owosso & Corunna Electric Co.
*Pacific Traction Co.
Paducah Traction Co.
*Pensacola Electric Co.
Peoples Railway Co.
Petaluma & Santa Rosa Railway Co.
Peterboro Radial Railway Co.

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*Indicates that the company became a member during the fiscal year ending September 30, 1907.

Philadelphia & West Chester Traction Co.
Philadelphia Rapid Transit Co.
Portland Railroad Co.
Portland Railway Co.
Pottsville Union Traction Co.
Poughkeepsie City & Wappingers Falls Electric Railway Co.
Providence & Danielson Railway Co.
Public Service Corporation of New Jersey.
Pueblo & Suburban Traction & Lighting Co.
*Raleigh Electric Co.
Rhode Island Co., The
*Richmond & Petersburg Electric Railway Co.
Richmond Light & Railroad Co.
*Roanoke Railway & Electric Co.
Rochester Railway Co.
Rockford & Interurban Railway Co.
Rock Island-Southern Railroad Co.
Rockland, Thomaston & Camden St. Railway Co.
Saginaw Valley Traction Co.
St. Joseph Railway, Light, Heat & Power Co.
San Antonio Traction Co.
San Diego Electric Railway Co.
San Juan Light & Transit Co.
Savannah Electric Co.
Schenectady Railway Co.
*Scioto Valley Traction Co.
Scranton Railway Co.
Seattle Electric Co.
Sheboygan Light, Power & Railway Co.
Sioux City Traction Co.
South Chicago City Railway Co.
*South-Western Traction Co.
Southwest Missouri Railroad Co.
Spokane Traction Co.
Springfield Consolidated Railway Co.
Springfield Railway Co.
*Springfield Traction Co.
Steubenville & East Liverpool Railway & Light Co.
Syracuse, Lake Shore & Northern Railroad Co.
Syracuse Rapid Transit Railway Co.
Tacoma Railway & Power Co.
Tampa Electric Co.
Terre Haute Traction & Light Co.
*Toledo & Chicago Interurban Railway Co.
Toledo Railways & Light Co.
Toledo Urban & Interurban Railway Co.

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* Indicates that the company became a member during the fiscal year ending September 30, 1907.

Topeka Railway Co.
Toronto Railway Co., The.
Tri City Railway Co.
*Trinidad Electric Railroad Co.
Tucson Rapid Transit Co.
Twin City Rapid Transit Co.
Union Electric Co.
Union Street Railway Co.
United Railways & Electric Co., The, (Baltimore).
United Railways Co. of St. Louis.
United Traction Co. (Albany).
Utah Light & Railway Co.
Utica & Mohawk Valley Railway Co.
Valley Traction Co.
Washington Railway & Electric Co.
Washington Water Power Co.
West Chester Street Railway Co.
West Penn Railways Co.
Whatcom County Railway & Light Co.
Wheeling Traction Co.
Wichita Railroad & Light Co.
Williamsport Passenger Railway Co.
*Winona Interurban Railway Co.
Winona Railway & Light Co.
Worcester Consolidated Street Railway Co.
York Street Railway Co.
Youngstown & Southern Railway Co.

Chicago & Milwaukee Electric Railroad Co. (Joined Association September, 1907, dues remitted).

Total Active Members in Good Standing October 1, 1907, 227.

### 1906 ACTIVE MEMBERS WHICH RESIGNED BEFORE OCTOBER 1, 1907

Old Colony Street Railway Co.
United Railroads of San Francisco.
Vicksburg Railway & Light Co.

| | |
|---|---|
| Total . . . . . . . . . . . . . . . . . . . . . . . . . . . | 3 |

### 1906 ACTIVE MEMBERS WHICH BECAME CONSOLIDATED WITH MEMBER COMPANIES DURING THE FISCAL YEAR ENDING OCTOBER 1, 1907.

Canton-Akron Railway Co.
Cleveland, Painesville & Ashtabula R. R. Co.
Connecticut Railway & Lighting Co.
Dayton & Western Traction Co.

| | |
|---|---|
| Total . . . . . . . . . . . . . . . . . . . . . . . . . . . | 4 |

---

*Indicates that the company became a member during the fiscal year ending September 30, 1907.

### 1906 Active Members with 1907 Dues Unpaid October 1, 1907.

Augusta & Aiken Railway Co.
Evansville Electric Railway Co.
Kansas City-Western Railway Co.
Madison & Interurban Traction Co.
Michigan Traction Co.
Northern Indiana Railway Co.
Portsmouth, Dover & York Street Railway Co.
Rutland Railway, Light & Power Co.
Winnebago Traction Co.
Total .............................. 9

### Old Member Companies Reinstated Since October 1, 1906, Because of Payment of 1906 Dues.

*Atchison Railway, Light & Power Co.
Benton Harbor-St. Joe Railway & Light Co.
Denison & Sherman Railway Co.
Illinois Central Traction Co.
Indianapolis & Northwestern Traction Co.
Jackson Electric Railway, Light & Power Co.
Lake Shore Electric Railway Co.
Lehigh Valley Transit Co.
*Levis County Railway.
Pottsville Union Traction Co.
†St. Louis & Suburban Railway Co.
United Traction Co. (Albany).
West Chester Street Railway Co.

| | | |
|---|---|---|
| Total .............................. | | 13 |
| 1907 dues unpaid .................... | 2 | |
| Consolidated ......................... | 1 | |
| | | 3 |
| In good standing October 1, 1907........ | | 10 |

### Reinstated Old Member Companies with 1907 Dues Unpaid.

Atchison Railway & Light Co.
Levis County Railway

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* Indicates that 1907 dues had not been paid up to October 1, 1907.
† Consolidated with a member company.

### RECAPITULATION OF ACTIVE MEMBERS.

*October* 1, 1907.

| | | |
|---|---|---|
| Member companies October 1, 1906 | | 200 |
| Resigned | 3 | |
| Consolidated | 4 | |
| 1907 dues unpaid | 9 | |
| | | 16 |
| Total 1906 member companies in good standing | | 184 |
| New member companies admitted during the fiscal year ending October 1, 1907 | 37 | |
| 1907 dues unpaid | 4 | |
| Total new member companies in good standing | | 33 |
| Old member companies reinstated after October 1, 1906, because of payment of 1906 dues | 13 | |
| 1907 dues unpaid | 3 | |
| Total reinstated companies in good standing | | 10 |
| Total active members in good standing | | 227 |

### CASH STATEMENT.

RECEIPTS.

(To October 1, 1907.)

| | |
|---|---|
| Cash in bank, October 1, 1906 | $6,976 90 |
| Company admission fees | 370 00 |
| Company annual dues | 22,550 00 |
| Associate membership dues | 790 00 |
| Rebate on rent 60 Wall street (Feb. 13 to March 1) | 43 75 |
| Sale linoleum, 60 Wall street | 20 00 |
| Postage Atlantic City hotels | 87 50 |
| Sale of rule books | 63 70 |
| Roanoke Railway & Electric Co., salary, C. F. Bryant, twelve days | 60 00 |
| Roanoke Railway & Electric Co., traveling expenses, B. V. Swenson, to Roanoke, Va., and return | 84 05 |
| Return premium fire insurance policy | 2 84 |
| Sale of 1906 reports | 8 00 |
| Sale American Street Railway Reports | 347 47 |

| | | |
|---|---|---|
| American Union Electric Co., received payment for space at a previous convention | | $13 84 |
| Exchange | | 10 |
| 1906 convention special agents' fee | $35 00 | |
| Sale of electros | 100 00 | |
| | | 135 00 |
| Interest | | 148 52 |
| Total receipts to October 1, 1907 | | $31,701 67 |

EXPENDITURES.

(To October 1, 1907.)

| | |
|---|---|
| Rent | $1,895 81 |
| Telephone | 155 10 |
| Telegrams and messenger service | 100 28 |
| Postage | 575 61 |
| Express | 560 06 |
| Freight and cartage | 121 22 |
| Printing and stationery | 1,638 50 |
| Salaries | 8,171 11 |
| Furnitue and equipment | 1,139 67 |
| Supplies | 212 51 |
| Sundry expenses | 617 63 |
| Traveling expenses | 962 71 |
| Books | 58 78 |
| Papers and periodicals | 53 07 |
| Annual Report, 1905 | 45 25 |
| Annual Report, 1906 | 2,878 04 |
| American Street Railway Association Reports | 221 50 |
| Exchange | 18 29 |
| 1906 Convention | 2,565 33 |
| Accountants' Association | 1,250 00 |
| Engineering Association | 1,423 25 |
| Claim Agents' Association | 900 00 |
| Total expenditures to October 1, 1907 | $25,563 72 |
| Balance in bank to October 1, 1907 | 6,137 95 |
| | $31,701 67 |

THE COAL AND IRON NATIONAL BANK OF THE CITY OF NEW YORK.

*October* 1, 1907.

*American Street & Interurban Railway Association, New York City:*

GENTLEMEN.— We beg to advise that the balance to the credit of your association on our books on October 1, 1907, was $6,137.95.

Very truly yours,
(Signed) DAVID TAYLOR,
*Second Vice President.*

*October* 8, 1907.

*To the Executive Committee of the American Street & Interurban Railway Association:*

GENTLEMEN.— I hereby certify that I have carefully audited the accounts of Bernard V. Swenson, treasurer of the association, for the fiscal year ending October 1, 1907, and that I have found the same correct.

The statements showing receipts for admission fees and annual dues from member companies and from associate members check with the books of the association, and proper vouchers have been audited covering all expenditures.

(Signed) M. R. BOYLAN,
*General Auditor, Public Service Railway Company, Newark, N. J.*

Respectfully submitted,
(Signed) B. V. SWENSON,
*Secretary-Treasurer.*

## *Discussion of the Annual Report of the Secretary and Treasurer.*

PRESIDENT BEGGS:— Are there any questions to be asked or any comments to be made upon this report? Do not hesitate, gentlemen, if there are any points in any of the papers that you do not understand, or upon which you think different action might have been taken, to give expression to your views. Such a course will make an interesting meeting and one of great value to the association. I therefore trust that every member will feel it not only his privilege, but also his duty, to let us hear from him if he has any different views from those expressed here.

(On motion, duly seconded, the report of the secretary-treasurer was approved and ordered to be printed in the proceedings of the association.)

PRESIDENT BEGGS:—The next order of business is one of the most pleasant we have to pass upon, and that is the addresses of the presidents of the affiliated and allied associations. I therefore have the pleasure of introducing to you Mr. C. L. S. Tingley, Second Vice-President of the American Railways Company of Philadelphia, who is President of the Accountants' Association.

## MR. TINGLEY'S ADDRESS.

*Mr. President, Ladies and Gentlemen:*

I must take exception to one thing that Mr. Beggs said, that this is the pleasantest part of the program. If I had had my way it would have been cut out. However, I try to be a good soldier and not shirk my duty. I take it that the object of having the presidents of the affiliated associations make addresses at this meeting is that they may in a way present a report and a message from their associations to the general association. I think that the message of the accountant's association this year is this: We are in a time when our companies are being brought under very close scrutiny by various public bodies, when it is necessary for the welfare of our business and the education of the general public that we should all stand together. Solidly, shoulder to shoulder, all these associations must present a united front in order to get a just and fair hearing from the general public. We have tried in our association during the past year to do this. We have done everything that we could to represent the association as a whole. There are many important questions coming before us, and one of the most important was alluded to by the president in his address, namely, that of depreciation. We are fast getting to the point where the American Association should discuss that question, which is rapidly passing beyond the realms of accountancy.

The time is brief this morning, you have a long program ahead of you, and I will not detain you further than to wish you a successful and interesting convention.

PRESIDENT BEGGS:—I now have the pleasure of introducing to you Mr. H. H. Adams, Superintendent of Shops of the United Railways & Electric Company of Baltimore, who is President of the Engineering Association.

## MR. ADAMS' ADDRESS.

*Mr. President, Ladies and Gentlemen:*

Mr. Tingley has referred to the messages which the affiliated associations are to present at this meeting. I desire to make the message of the engineering association an expression regarding the work of the standardization committee. President Beggs has referred to this work in his address, and I have had a great deal to say about it in our meetings of Monday and Tuesday. I feel that it is an extremely important subject and one that should be brought before the heads of the various systems of this country so that they may realize the work that has been done.

We have had a standardization committee in our association for the past two years. It made a report of progress at the 1906 convention held at Columbus. The report this year is complete and full, as far as it was possible to go in the limited time that the committee has been at work, because the subject is a vast one. This report was accepted and adopted by our engineering association by a unanimous vote. The report is referred to the American association for its approval and adoption.

The subjects the committee has already considered includes axles, journals, journal boxes, brake shoes and heads, and wheels; comparatively few items in number, but you all appreciate the vastness of the whole subject. Taking it for granted, that this association is going to adopt the report, I now want to ask the support and approval of the report by the systems or the roads composing the membership of this association. If you are going to take the report and pigeonhole it, the work of the committee will be of no avail. The report must be adopted and put into practice. It is an able report, and worthy of your adoption. I suggested in my address before the engineering association that these standards should be incorporated in specifications and in rebuilding of equipment that might be under way. In this way the standards can be adopted with the least possible expense.

I desire to refer especially to the thorough work that this committee has done upon this report. You can judge somewhat of this when I tell you that at one of our meetings in New York, when I left to take the midnight train for Baltimore the committee was still in session. The session ended, I believe, at 1:00 o'clock, simply adjourning to meet again the next morning to close up the report. That has been the spirit of the committee right through its work. But this report goes farther than the report of the committee. It carries with it the cooperation of the manufacturers. They have been working hand in hand with the committee. The representatives of all the manufacturers interested were invited to be present at the meetings of the committee, and this report, as I stated before, is the work of the committee and of the manufacturers together, and I desire that the report be put before you in this manner for your close attention. I thank you.

President Beggs:— We all know that a great many of the nickels collected on our cars trickle out through the claim department, and we do not appear to have anything left. It was very gratifying indeed to me, when, on Monday afternoon, I said a few words to the Claim Agents at their opening meeting, to find a room so well filled.

It is of great importance to our interests that these gentlemen should come together, exchange ideas and experiences, and see whether some means can be adopted to prevent or check to some extent the impositions that are practiced upon all the roads throughout the country. I therefore take great pleasure in introducing Mr. H. C. Bradley, Claim Agent of the Chicago Union Traction Co., and Acting President of the Claim Agents' Association.

## MR. BRADLEY'S ADDRESS.

*Mr. President and Gentlemen of the Convention:*

I do not suppose that it is necessary for me to call your attention to the fact that I represent in a corporation the most despised department connected with it. There is no way that I can contrive or conceive of whereby we can make it a source of revenue. Therefore there is very little to be said on the subject of a claim department. One of the principal things is, settle your accidents as cheaply as you can, and induce your operating department to make as few as possible.

The claim department of a railway company is the most expensive, as well as the most unpopular department connected with the corporation, for the reason there is no way in which a favorable showing can be made for the large expenditures which appear to be steadily increasing, caused by not only the natural increase, but also by the army of dishonest and unscrupulous lawyers and physicians.

The formation of the Claim Agents' Association has been a great help and benefit to the corporations which the agents represent. It has brought together claim agents from all parts of the country, who, through the organization, have become personally acquainted and therefore more interested in aiding and assisting each other than would have been possible prior to organization of the association.

The officers of the operating department of a railway corporation can assist the claim agent very materially in keeping down the expense by adopting only the very latest and most improved appliances for avoiding accidents and by constantly drumming into the minds of the employes operating the cars the necessity and importance of doing their utmost to observe the rules which are laid down for them by the managers.

The Claim Agents' Association is progressing favorably and is in a vigorous and healthy condition and I desire to express my thanks to the officers of the American Association for their kind and courteous consideration and support during the past year.

President Beggs:— I now have the pleasure of introducing to you the president of our allied association which does so much for our comfort and entertainment at these conventions, and which has prepared and has ready for us this great exhibit of the most important appliances used in our great industry. I therefore take great pleasure in introducing to you Mr. James H. McGraw, President of the Manufacturers' Association.

## MR. McGRAW'S ADDRESS.

*Mr. President and Gentlemen of the Convention:*

If, as the last speaker said, the claim department is the most expensive department of the traction companies what will you say of the manufacturers? I fancy that if the street railways were not obliged to pay the bills of the manufacturers they would all be able to pay larger dividends on the stock and securities of the companies.

Mr. President, I am very glad to stand up and be counted in behalf of the Manufacturers' Association this morning, but, as you all know, the manufacturers are people of deeds and action rather than of much speaking. I take it, therefore, that as there is much business to be accomplished by the convention this morning you will expect only a word from me as representing the Manufacturers' Association. Old things pass away and new things come. Four years ago it was decided by the officers and the executive committee of the association that the old policies and the old methods were no longer useful and adequate in the development of this association, and back of it in the development of this great industry. Therefore, President Ely and his associates on the executive committee, undertook the reorganization of the American Street Railway Association, and the suggestion came to the manufacturers from the parent organization itself that they organize and that they lift the burden, if you please, that had settled down upon the shoulders of the association in the way of the exhibits and the entertainments that were supplied by the local companies at those conventions. It had become a burden for the reason that the local company in inviting the convention also invited the manufacturers, and in a large measure was supplying the space for the exhibits at that time. The manufacturers organized. For four years they have taken care of the exhibits, and they have taken care of such entertainment as has been placed at your disposal. At St. Louis it was not necessary to have an exhibit, as the exhibits were all placed in connection with the exposition. At Philadelphia, all of you who were there, remember the display of exhibits, which up to that time exceeded anything that had been attempted. It grew still larger and better at Columbus last year. This year at Atlantic City it is the most magnificent display that we have ever been able to put together; we have about 75,000 square feet exclusive of floor space, covered with exhibits. The association has about two hundred and seventy-five members and the number of individual exhibits at this convention is two hundred and ten. Therefore, Mr. President, we feel that the manufacturers' association has justified its existence. We feel that it is a pleasure, and we are proud to feel that we are a part, and cooperate with this magnificent association, the American Street and Interurban Railway Association that has at last taken its proper place among the foremost scientific bodies of America. We feel that there is a great work still before us, and that there is a great work still before you.

I think no one will question my statement when I say that the American street railways have done and are doing a work for the so-called common people, and for the masses of this country far greater and more important than has been done or undertaken by any other single industry of this country. Therefore, gentlemen, we ought to be proud of this great work to which so many of us are devoting the best years of our lives.

The success of the Manufacturers' Association, gentlemen of the convention, is due largely to the backing and the cooperation and the support that we are receiving from the president and executive committee of the American Association. It was you, gentlemen, who brought the Manufacturers' Association into existence. We will stand shoulder to shoulder with you and cooperate and help to lift the burden in this work, to the best of our ability, but we want your advice and cooperation and suggestions, as we have had them in the past.

I want to publicly in this manner thank Mr. Beggs and his associates on the executive committee for what they have done for us in our work. I also want to thank the Hotel Men's Association of Atlantic City for the hearty cooperation and for the generous effort they have made in helping to put the convention in Atlantic City, and especially with reference to the exhibits here on the steel pier. They promised us everything, ladies and gentlemen, even to good weather, and they are making good.

Mr. President, I wish you and the members of the association great success in this convention. We hope it may be the best that you have ever held in the history of the American Street and Interurban Railway Association.

PRESIDENT BEGGS:—Mr. McGraw, in behalf of the American Association, I desire to thank you and through you the Manufacturers' Association, and I would be pleased to have you convey to your association at its meeting to-morrow, the expression of appreciation of this association of the great work you have done, and are still accomplishing in behalf of the members of this association.

MR. McGRAW:—Mr. President, if you will pardon me, I will add a word in regard to the test car "Louisiana," mentioned in the report of the executive committee. I was secretary of the Electric Railway Test Commission of the St. Louis Exposition. The car was turned over by our commission to your association. The commission requested all the manufacturers who had loaned or given apparatus for that car to continue the loan of the apparatus indefinitely.

No definite action, so far as we know, was taken by any of the manufacturers. At least we did not get together satisfactory replies. The commission went out of existence some two years ago. It is not in a position to act at the present time, but I have this to say, Mr. President, that if that car is important to the American Street and Interurban Railway Association, which I have doubted from the action taken by the executive committee, and the association will go on record to that effect, I feel that the manufacturers will be glad to supply this apparatus free of cost, and I feel that the car can at this time be rehabiliated.

President Beggs:—The next order of business is the announcements.

## ANNOUNCEMENTS.

Secretary Swenson made the announcements as follows:

The following named companies have joined the association since the beginning of the fiscal year on the first of October: Joliet & Southern Traction Co.; Lorraine Electric Railway Co.; Washington, Baltimore & Annapolis Electric Railway Co.; Yegan Brothers Power Plant; Albany & Hudson R. R. Co.; The Enid City Railway Co.; Quincy Horse Railway & Carrying Co.; Joplin & Pittsburg Railway Co.; Easton Transit Co.; Tri-State Traction Co.; Philadelphia & Western Railway Co.; South Shore Traction Co.; Buffalo & Lake Erie Traction Co.; Syracuse & Suburban R. R. Co.; Sterling, Dixon & Eastern Electric Railway Co. This brings the total active membership up to 242 companies.

The associate membership on October 1, 1907 was 148; and we have added 22 new members since that time making a total to date of 170.

An invitation has been received from the Asbury Park Convention Bureau, asking us to hold our next annual convention at that city.

President Beggs:—This invitation will be referred to the incoming executive committee, which is charged with the duty of locating the next place of meeting for the association.

The next order of business is new business, and we are now ready to hear from the floor.

## NEW BUSINESS.

Mr. Wyman:— I desire to offer the following amendment to the by-laws, the idea being to carry into effect the very excellent suggestions made by the president and the executive committee with reference especially to the past presidents of this association. The amendment I offer is as follows:

That article (VI), paragraph (a), of the by-laws of the American Street and Interurban Railway Association be amended to read as follows:

"The entire charge and management of the affairs of the association shall be in the hands of the executive committee, which shall consist of the president, vice presidents, one member appointed by each affiliated association, and all the past presidents of the American Street and Interurban Railway Association and its predecessor, the American Street Railway Association, these past presidents to be honorary members of the executive committee, but without power to vote at meetings of the committee. The executive committee shall make arrangements for carrying out the objects of the association."

On motion, duly seconded, this amendment was formally adopted by the convention.

President Beggs:— I desire to say that if any member has any resolution to offer, or other matter which will be of general interest, it will be entertained at any time, even if it is not strictly in accordance with the rules of order.

As stated in the executive committee report which was read earlier in the session, the Atlantic City Hotel Men's Association presented a proposition for consideration at the meeting of the committee held yesterday afternoon. This proposition, looking toward Atlantic City as a permanent meeting place, will be formally presented to the convention for consideration at the Friday morning session. I will not dwell upon it at this time more than to say that the proposition appears in this morning's issue of the Electric Railway Review and it is important that the delegates to all of our associations should give it careful consideration.

Next is the report of Committee on Membership. There is no report from this committee further than the report of the secretary and treasurer which sets forth the names of the companies and individuals having joined the association during the fiscal year ending September 30, 1907.

Next is the report of the Committee on Compensation for Carrying United States Mail. The chairman of this committee, Mr. G. Tracy Rogers, is expected here to-morrow. Consequently the report will be postponed until that time.

The next order of business is the report of the Committee on Subjects. Mr. Richard McCulloch, chairman, of St. Louis, is present and will make the report.

## REPORT OF THE COMMITTEE ON SUBJECTS.

*To The American Street and Interurban Railway Association:*

Gentlemen: — It is hardly necessary for the Committee on Subjects to submit a formal report. Its report consists of the schedule of arrangements and the papers submitted at this convention.

In making the schedule an effort has been made to arrange the meetings of the various associations so that meetings of a similar nature will not conflict. By arranging the meetings of the Engineering and Claim Agents' Associations for Monday, Tuesday and Wednesday, those of the Accountants' Association for Tuesday, Wednesday and Thursday, and those of the main association for Wednesday, Thursday and Friday, an opportunity is given a delegate to attend the meetings of one association in three days, or the meetings of all in five days. As far as possible, the schedule has been arranged so that the time of meetings of a similar nature will not conflict.

For several proposed subjects the committee was not able to obtain writers and as these are important subjects, it is hoped that a discussion of these topics may be secured for next year.

If it is within the province of this committee to make recommendations for next year, the committee would recommend that the new Committee on Subjects be appointed at this convention. This new committee should lay out the program for 1908 at once, so that the work of selecting authors for the papers, which is the principal work of the committee, may be entered upon without delay.

Respectfully submitted,
Richard McCulloch, *Chairman.*
Ernest Gonzenbach,
R. E. Danforth,
C. L. S. Tingley,
H. H. Adams,
B. B. Davis,
*Committee on Subjects.*

On motion, duly seconded, the report of the committee was approved.

President Beggs:—The next order of business is the report of the Committee on Car Wiring which will be presented by the chairman, Mr. John W. Corning, of Boston.

## REPORT OF THE COMMITTEE ON CAR WIRING.

*To the American Street and Interurban Railway Association:*

Gentlemen: — Following their appointment in February, the members of your committee received from the secretary of the association a request for views concerning the changes suggested in the rules of the Underwriter's National Electrical Association relating to writing and equipment of street railway property including rolling stock. The material was desired for use at the annual meeting of the Underwriters held in New York the latter part of March. Through a misunderstanding as to the date of this meeting your committee was not represented.

The chairman was then instructed by the secretary of the association to obtain a copy of the approved changes in the rules to see what suggestions concerning them and the other rules might be made with advantage to street railway companies.

Your committee's views were brought to the attention of the Underwriter's representative by the chairman with the result that the approved changes were modified before being published in the 1907 edition of the "National Electrical Code," as follows:

| As approved by Underwriters Ass'n at meeting in March, 1907. | As modified and appearing in edition of code, published in July, 1907. |
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| Rule 28, sec. b (flexible cord).<br>"Must not be used where the difference of potential between the two wires under normal conditions is over 300 volts." | Rule 28, sec. b (flexible cord).<br>"Must not be used where the difference of potential between the two wires is over 300 volts."<br>Supplemented by the following fine print note:<br>"The above rule does not apply to the grounded circuits in street railway property." |
| Rule 33, sec. c (car houses).<br>c. "Must have a cut-out switch located at a proper place outside of the building so that the trolley wire in the building can be cut | Rule 33, sec. c (car houses).<br>"Must have an emergency cut-out switch located at a proper place outside of the building, so that all the trolley wires in the |

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| out at one point, and section insulators must be installed so that when this cut-out switch is open the trolley wire will be dead at all points within 100 feet of the building. The current must be cut out of the building whenever the latter is not in use or the road is not in operation." | building may be cut out at one point, and line insulators must be installed, so that when this emergency switch is open, the trolley wire will be dead at all points within 100 feet of the building. The current must be cut out of the building when not needed for use in the building."<br>Fine print note added as follows: "This may be done by the emergency switch or if preferred a second switch may be used that will cut out all current from the building, but which need not cut out the trolley wire outside as would be the case with the emergency switch." |
| Rule 33, sec. e (car houses).<br>4. "Must have all rails bonded at each joint with a conductor having a carrying capacity at least equivalent to No. 00 B. & S. gage annealed copper wire. All rails and all lighting and stationary motor circuits must be connected to the outside ground return circuit by a No. 00 B. & S. gage copper wire, or by equivalent bonding through the track." | Rule 33, sec. e (car houses).<br>3. "Must have all rails bonded at each joint with a conductor having a carrying capacity at least equivalent to No. 00 B. & S. gage annealed copper wire, and all rails must be connected to the outside ground return circuit by a not less than No. 00 B. & S. gage copper wire or by equivalent bonding through the track. All lighting and stationary motor circuits must be thoroughly and permanently connected to the rails or to the wire leading to the outside ground return circuit." |

Examination of these modifications will show that they permit of a more liberal application of the rules to street railway property than was the case in their originally approved form, and it was possible to have these changes brought about because they did not materially affect the principles involved.

Your committee would further suggest a change in Rule 32, sec. f (Lighting and Lighting Circuits), as follows: Clause reading, "No lamp of over thirty-two candle power to be used," to be changed to read, "No lamp consuming more than 128 watts to be used." This change is suggested as it was evidently the purpose of the old rule to limit the power consumption through a single outlet, rather than the quantity of illumination; and the advance made in incandescent lamp manufacture in the past three years has greatly increased the possible illumination for the same consumption of power.

There are two suggestions which, from their nature, call for more radical changes in the rules than could be approved by the Electrical Committee without the sanction of the Underwriter's Association in annual meeting.

The first relates to Rule 32, sec. g, paragraph 2 (Heaters and Heater Circuits), and calls for its modification in such a manner as to allow the use of a truss plank heater by providing a thickness of 3/16-in. of approved fire-resisting insulating material between the back of heater and truss plank.

The second refers to Rule 33, sec. e, paragraph 3 (Car Houses), which requires bonding for all rail joints to have a capacity at least equivalent to No. 00 B. & S. gage copper wire, and it is suggested that No. 0 B. & S. gage wire should be large enough and might reasonably be specified.

For the reasons above stated it would seem best to refer these suggestions to the succeeding committee, to be taken up by it with the Underwriters and have them acted upon at their meeting next year, and this course your committee respectfully recommends.

Respectfully submitted,

JOHN W. CORNING, *Chairman,*
C. B. KING,
L. P. CRECELIUS,
HUGH HAZLETON,
I. D. SHIPPER,
*Committee on Car Wiring.*

### *Discussion of Report of the Committee on Car Wiring.*

MR. SWEETLAND:— As chairman of the Committee of the National Board of Fire Underwriters on Car Wiring, or as it is known now, the Wiring of Street Railway Property, including Rolling Stock, I know that that committee will be pleased to receive any suggestions from this association. The two points on which Mr. Corning requests a conference, would have been taken up before the last meeting of the Electrical Committee, which was held in March, had they been in our hands in season for consideration. We will be pleased to receive any suggestions relating to the wiring, not only of cars, but of street railroad properties in general.

PRESIDENT BEGGS:— We are very glad to have that assurance, Mr. Sweetland. We recognize that our interests are absolutely mutual. There have been many exacting regulations formulated by the underwriters in past years simply because those who understood better the hazards and the method of preventing fire in our properties were not sufficiently frank with the underwriters. If the underwriters can show certain methods of wiring are best, why, we are the direct beneficiaries, because we cannot afford to have a fire.

On motion, duly seconded, the report of the Committee on Car Wiring was approved.

PRESIDENT BEGGS:— The next order of business is the report of the Committee of Standardization of Equipment. The chairman Mr. H. C. Page, of Springfield, Mass., is here and will present the report.

## REPORT OF THE COMMITTEE ON STANDARDIZATION OF EQUIPMENT.

*To the American Street and Interurban Railway Association:*

GENTLEMENS — Your committee appointed to investigate and report on the standardization of equipment begs leave to submit for the approval of the American association, the report of the Committee on Standardization of Equipment of the Engineering Association, copy of which is presented herewith.*

Respectfully submitted,

H. C. PAGE, *Chairman.*
T. W. WILSON,
JOHN MURPHY,
H. A. NICHOL,
W. H. EVANS,
*Committee on Standardization of Equipment.*

**Editor's Note.*— The complete report of the Engineering Association Committee on Standardization of Equipment will be found on pages 147 to 153 of the 1907 Proceedings of the Engineering Association.

### *Discussion of Report of the Committee on Standardization.*

PRESIDENT BEGGS:— This report has been exhaustively considered by the Engineering Association, and it is now before the American Street and Interurban Railway Association for action. I know with what industry and earnestness the members of the Committee of the Engineering Association have considered this matter. This report is only a recommendation reached after consideration by those best qualified to determine what is best to adopt on behalf of the association. We may not all be able to adopt all the recommendations at the same time, but if we work toward the general object proposed to be attained by the appointment of this committee, it will be greatly to the advantage of every company in this country.

If we could have one standard, say of axles, it would facilitate obtaining supplies throughout this country. As it is now, nearly every company has some peculiar diameter, or some peculiar curve on axles and wheels and brake shoes, that makes it necessary for the manufacturers to do special work and that all tends to cost more money. The standardization of these parts of equipment will tend to lower the prices and facilitate their manufacture. I am speaking now to practical men spending large amounts of money for this apparatus. I think it is highly important and therefore we can each of us afford to sacrifice some details to get down to a standard.

Mr. Lang:—I attended the meeting of the Engineering Association yesterday afternoon, and I was very much interested in this report and the discussion upon it. I am satisfied that the committee has labored zealously to bring about a report that would meet the conditions as well as may be. It did not feel that it could do any more than recommend it to this association for its adoption, of course, but it seems to me that it is such an evidence of progress that we should put our stamp of approval upon the work of the committee, and thus let it be known throughout the country that we are accomplishing something by these annual meetings.

In order that we may bring out criticism and opposition, if there is any, I move that we approve and adopt this report as the standard for the guidance of the members of this association.

The motion by Mr. Lang was duly seconded, and was passed by an unanimous vote.

President Beggs:—I shall be very glad to report that action to the Engineering Association, as an evidence of the confidence we have in its ability and earnest devotion to this work.

Mr. Adams:—Mr. President, as president of the Engineering Association, I desire to express my thanks to you, Mr. Lang, and the other gentlemen, for the cordial support of the report of the Standardization Committee of the Engineering Association.

PRESIDENT BEGGS:— The next order of business is a paper, "The Technically Trained Man and the Electric Railway Profession," by Prof. H. H. Norris, Cornell University, Ithaca, N. Y. Mr. Norris is present, and I know we will all listen to him with a great deal of pleasure, knowing the conscientious care that he always puts upon any paper of this kind.

# THE TECHNICALLY TRAINED MAN AND THE ELECTRIC RAILWAY PROFESSION.

By PROF. HENRY H. NORRIS,
Cornell University, Ithaca, N. Y.

It has only been a few years since many practical business men considered that a technical education had a tendency to render young men unduly theoretical and hence unpractical. There was good reason for this belief in many cases, for the young men as well as their employers had incorrect ideas of the purpose of a technical education. As pointed out by the writer in a recent paper before the American Institute of Electric Engineers,* the purpose of a technical education is not to teach trades, nor to directly produce business or professional men. The technical school is intended to educate young men in the best sense of the word, and the education which does not make young men better business or professional men is not a satisfactory education. A few years ago there were three classes of employers; the first placing too high, the second too low, and the third, a correct estimate upon the value of a technical education. The first class of employers placed too much responsibility upon the young men at first, supposing that they were already engineers. As a consequence many failed to meet the expectations, and gave apparent reason for criticism of their technical training. The second class of employers, not realizing the purpose of technical education, failed to take advantage of it, and did not give the young men suitable opportunity to rise. The third class of employers fortunately realized both the shortcomings and the merits of technically trained young men. Opportunity was given for overcoming the former, and the latter were utilized by placing such responsibilities upon the shoulders of young men as they were able comfortably to carry.

The manufacturers were the first, and have been foremost in utilizing the product of the technical schools. They have carried this to such an extent that apprentice courses are offered by all of the large companies, and the young men are given every possible opportunity to develop normally and quickly. They are taken through all departments of the works, learning in each enough of the detail to enable them to appreciate the reasons for the development of existing forms of apparatus, and for the employment of present methods of construction. They test the finished product and so learn what to expect of the various classes of machines.

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*Transactions A. I. E. E. July, 1907.

The operating companies are now taking this matter actively in hand, and a few lighting companies have developed courses similar in purpose, but necessarily different in plan from those of the manufacturers. The Denver Gas and Electric Company was a pioneer in this direction, and its example is being followed by other companies.

The purpose of the present paper is to inquire of the members of this association whether or not it is practicable for them to institute something corresponding to the apprentice courses of the manufacturing and lighting companies. Some years ago at the request of the New York State Street Railway Association, the writer conducted an investigation to determine the attitude of the members of that association toward the technical school.* The result of this inquiry was to find that technical graduates are favorably regarded by the officers of the railway companies. At that time technical graduates were found mostly in the engineering departments, although some had risen to managerships and superintendencies. In response to an inquiry as to how young men should go about entering the electric railway field, the replies were not entirely satisfactory. The general advice was to begin at the bottom and to work up, the first position being a matter of small consequence. There was, however, no systematic way by which a young man fresh from college could learn the electric railway business nor, as far as the writer is aware, is there any at the present time. While it is natural that the graduates should find their way first into the engineering departments, it is the firm conviction of the writer that if their training is a success, the young man should be equally well adapted to the other departments, provided, of course, they have the necessary personal qualities for superintending and managing.

The men who are now controlling the electric railway companies have largely grown up with the industry. The experience of many dates back before the early nineties, when the horse was supplanted by the electric motor. These officials are now training young men to take their places when they retire, and they naturally desire to find for this purpose individuals with the necessary characteristics and training. For many reasons they have the right to expect the technical schools to supply the class of men required. The first of these is that the technical schools should, and probably do, attract a large proportion of industrious, active and capable students. A young man who has the nerve and ability to conquer the difficulties of a technical training, especially if he is financially handicapped, ought to be one who is needed in business. In the second place, the mental and physical discipline tends to bring out his good qualities and make him self-reliant and original. It increases his initiative power, the most important business qualification which he can possess.

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* Proceedings N. Y. S. R. A. 1904, p. 187.

It is surprising that such a comparatively small number of the technical graduates find their way into the electric railway business. Of the more than two thousand graduates of Sibley College, probably not more than fifty are directly or indirectly engaged in this line. Of these, quite a proportion are in the supply business, and only a small number are actually in the field. This is probably not because railway work is not attractive, but as other fields have been so much easier to enter that they have attracted the bulk of the graduates. Some kind of an apprentice course would be welcomed by technical students. They enjoy any work in this direction that is given in the schools, and they show great aptitude for it.

To make the matter entirely practical the following arrangement is suggested for such a one and one-half year's course

### TENTATIVE PLAN FOR AN EIGHTEEN MONTHS' APPRENTICE COURSE.

(1) *Three months in Master Mechanic's Department.* This time should be largely spent in the car barns and repair shops. The apprentice can serve as helper on car inspections and repairs, construction of special parts, tests, etc.

(2) *One month in Purchasing Agent's Department,* partly as assistant to the storekeeper, and partly as general assistant to the purchasing agent.

(3) *Three months in Motive Power Department.* This time should be spent as general helper, oiler or in any other capacity in which the apprentice could be made useful. He could also assist on tests, designs for repairs and inspections. He could also act as emergency supply for sub-station attendance. A short time in the superintendent's office would familiarize him with the details of administration.

(4) *Two months in Transportation Department.* The apprentice could be given miscellaneous work in connection with the preparation of time tables; he should familiarize himself with the train despatching system, and, in general, make himself useful to the superintendent. In many ways he could assist in this department as emergency supply in ticket offices, on express cars, etc.

(5) *Two months on outside line work.* The apprentice could be employed as assistant with the repair gang, and he could also make himself useful in construction of new work, testing, repairs to instruments, etc.

(6) *Three months in Way Department.* This time should be spent in office work, laying out details of new construction of track, bridges, etc. The apprentice should also assist in surveying and other field work.

(7) *Two months in Comptroller's Department.* This time should be spent as general office assistant, and in conducting special investigations for the financial officers of the company. A technically trained man would be well equipped by this time to be of great assistance in compiling statistics. These cover not only the opera-

tion of the company itself, but of other companies. The apprentice would thus become familiar with the methods of accounting used, and of the relation of this department to the others.

(8) *Two months in General Manager's Office.* The apprentice should now be in a position to be of practical use to the manager, and could be detailed to special duties which happened to demand attention.

One and one-half years have thus been scheduled and sub-divided among various departments with a view to preparing the apprentice for any line of work in the railway field which may happen to be open to him. He has had the opportunity to demonstrate his peculiar abilities and disabilities, and if he has "stood by" for the full period, he has shown his appreciation of the opportunity. It is obvious that a very large company could handle a number of such apprentices without serious difficulty, if the officers in charge of them were in hearty sympathy with the idea. The plan requires the cooperation of the heads of all departments, and there are numerous objections which appear as soon as the scheme is suggested. The young men are in the various departments such a short time that they are not able to work at maximum efficiency. Further, it requires a little effort on the part of the superintendents of the various departments to lay out the work for the apprentices. The young men are apt to leave, and thus the company loses the benefit of the effort expended. On the other hand, opportunities are constantly arising in every company, demanding loyal, well-trained employes. These are difficult to obtain and could be picked out instantly from the apprentice corps. Smaller companies by slight modifications could use the same general plan, and with the same results.

The matter of pay for the apprentices is one of practical importance. It is not to be expected that they will be able to earn as much as men regularly employed in the departments. On the other hand, they should be expected to earn for the company as much as possible. Their wages should be based more upon a reasonable living expense, than upon their earning capacity. This will depend upon the cost of living in various communities. Probably from ten to twelve dollars per week at the start, with a reasonable increase at the end of each six months' period, would be reasonable and satisfactory to all concerned.

This paper is not intended to recommend that companies go into the apprentice business on a wholesale scale. If each year one or two men could be employed by the smaller, and half a dozen or more by the larger companies, there would be a sufficient supply of new material always in processes of development. Of the men hired probably one-half would drop out before the end of the period, and those who remain would naturally be the ones best fitted for the work. From the writer's personal experience he is aware in a general way of what the companies need in this line, because he has the frequent privilege of recommending young men for various positions in electric railway work. In every such case if the apprentice corps were in existence the needs of the company could have been met better within their own organization.

### *Discussion of Professor Norris' Paper.*

PRESIDENT BEGGS:— Professor Norris, the association is under obligation for the care that is shown in the preparation of this paper and for the very pertinent and practical suggestions made in it.

The paper is now open to discussion.

MR. BLAKE:— Professor Norris' discussion on the technially trained man and the electric railway profession is the first paper which I recall which has been presented at a street railway convention by an active professor in one of our larger universities. In view of the large number of men who are graduating as electrical engineers from our technical schools into other branches of the electrical business, it is very desirable that a paper of this kind should be presented before the association, and it is appropriate that the topic should be suggested by one who has done so much for the street railway industry and association as Professor Norris.

Courses in engineering other than those required by military or civil engineers have received university recognition for a few decades only. But the tremendous demands during the last twenty or thirty years for technically trained men in all branches of engineering has resulted in the establishment of new scientific institutions and the expansion of the engineering department of most of the older universities. These courses have proved so popular that the engineering students who formerly constituted only a small percentage of all those enrolled at the older universities, now equal in number the students in the academical departments if they do not exceed them. A tabulation was made last June by the editor of the "Electrical World" of the different schools engaged in engineering education. It showed that after omitting all manual training schools, as well as all colleges and universities which taught electrical theory only as a part of a course in physics, there were in this country 117 schools which have electrical engineering courses. Omitting from this number those institutions in which the electrical course is embryonic only or is purely academic in character, there remain at present 96 schools which teach electrical engineering either as an entirely separate branch or as a specialization in mechanical engineering. These schools had in the year 1906–07, 8,929 electrical engineering students enrolled and had graduated 10,959 men from their electrical engineering courses. Of this number, 1,358 men were graduated in 1907.

No statistics were obtainable as to how many of these graduates had entered the electric railway field or how many of the undergraduates were expecting to do so, but it is safe to say from the specialization of electric railway engineering in a number of schools, and the large amount of time given to it in all of them, a considerable percentage of the undergraduates are prepared to do good service in this branch of electrical engineering. The practical question then arises whether the electrical railway companies are prepared to utilize the services of these men to the same extent as they are sought in other branches of the work.

To some it may seem that 1,400 new electrical engineers a year, soon probably to rise to 2,000 or more, will be greater than the absorptive qualities of the general electrical field, vast as we know it to be. This would probably be true if their activity should be confined to purely engineering work, but this is by no means the case. The demand for technically trained men from manufacturing, commercial, operating and, to some extent, financial corporations as well, is probably greater than ever before. In fact, it may fairly be doubted if the schools are turning out nearly as many men as can be utilized with benefit to the electrical industry and with profit to the graduates. Experience has shown that the technical training which a man receives in any one of our higher class engineering institutions gives him a grounding in scientific principles and a discipline of mind which will enable him more easily to adapt himself to any department of work than if he had not enjoyed that advantage. This fact has been clearly recognized by the manufacturing companies, most of which offer especial inducements to college graduates to become associated with them. To cite an example, one large electrical manufacturing company took on its force 243 new college graduates this summer. A successful manager of a number of electric lighting properties has made a college degree a condition of employment to any position looking forward to responsible work, whether connected with the engineering or the operating departments of his various corporations. He says that the mental discipline received in a university enables the graduate to adapt himself quickly to practically any department in which he may be placed, and that the chances are greater that he will develop the ability requisite for the work than one who had not received the same technical training. Many of the steam railroad companies make a special effort to secure technical men to recruit their ranks.

Professor Norris' paper suggests a concrete plan by which the results secured by other companies in utilizing the college garduate may be carried out by street railway companies. His apprentice course of some 18 months should form an excellent method for learning the practical application of the principles acquired at the university, and the establishment of a trained corps of men in the way suggested by him should be of great future assistance to the railway companies.

President Beggs:— There is among us this morning a gentleman who, after graduating from one of the colleges of the country, entered the service of what was then the largest and which is possibly still the largest interurban railway company of the country — the Indiana Union Traction Company. He entered the service of this company and finally became its chief engineer, and then became the head of the electric railway course in the Worcester Polytechnic Institute at Worcester, Mass. I have the pleasure of calling upon Professor Richey.

Professor Richey:— In my work in Indiana, I had considerable opportunity to use technical graduates. It was the policy of the Indiana Union Traction Company to offer positions to technical graduates — minor positions, as substation operators, helpers, etc. We had no regular apprenticeship course, but at nearly all times for several years we had technical men learning the electric railway business, or some parts of it. Some of those men, besides making good for themselves, made good for the company, and with the Indiana Union Traction Company now the heads of at least two of the important departments are filled by such men. Other men, of course, made good, but left the company and went with other companies. Those other companies profited by the experience which was given those men by the Indiana Union Traction Company, but with very few exceptions our company got its money's worth out of them while they were with us. The exceptions were much more rare than the general average of all the employes of the company. If it had been possible to have put those men through such a course as the one suggested by Professor Norris, they would have become much more valuable to the company and in much shorter time than they did with our less systematic methods.

The manufacturers, of course, realize the importance of apprenticeship courses. Mr. Blake spoke of a large number of technical graduates who were going out to them every year. That this number is yet to grow may be shown by the fact that each spring, two or three months before commencement time, representatives of the different large electric manufacturing companies, make visits to the technical schools and solicit men to come with their companies. They can't get enough of them, and I think that while they are offering advantages which are better and better every year, that it would be a good idea if the electric railway companies would formulate some scheme such as has been suggested, and get the benefit of more of these men than they are at present.

The technical schools are taking an interest in this electric railway work. Worcester Polytechnic Institute, which is a small institution, compared with many others through the country, has just completed an electrical engineering laboratory which with its equipment represents an investement of about a quarter of a million of dollars, and between one-third and one-fourth of that investment represents equipment which is devoted to electric railway work. Ten of our men who are taking post graduate work in electrical engineering this year, are, every one of them, taking the electric railway engineering course. Three of these ten men have been interested enough in your association to become associate members, and to come down here from Worcester at their own expense — and that expense to a student means more than it does to you — for what they can get out of it. That gives you some sort of an idea of the interest that is being taken by the technical schools and by the technical students in electric railway work. But the technical schools can only give a foundation in electric railway engineering. We are giving the men what we can. We are giving them all that we can with the money that we have to invest in equipment, and all that we can with the facilities that we have. The men must have some actual experience before they make electric railway engineers, before they make engineers of any sort. That is the reason why this request or suggestion has been made for a sort of apprenticeship course which will round out the work of the technical schools more quickly and in better shape than the less efficient plan of starting a man at the bottom and letting him work up through whichever one department he has happened to start with.

There is another way in which the technical schools and the American Street and Interurban Railway Association might cooperate. As I mentioned before, some of the technical schools have put a great deal of money into experimental and other equipment which is particularly suited to testing and experimental work.

Purdue University and the Master Car Builders' Association have had working arrangements for a number of years, Purdue University having a splendid laboratory for railroad experimental work, and that the arrangement is mutually profitable is shown by the fact that it has been kept up from year to year, the university laboratory making various tests and experiments for the association. Some such working arrangement as that might be gone into by this association with the various technical schools which are taking up the electric railway work, and which have put money into equipment especially fitted for that sort of work.

Just one thing comes to my mind now, from the report of the Committee on Maintenance of Electrical Equipment — the very great divergence of opinion as to the best quality of brush for use on railway motors. It cannot be possible that the very hardest brush is the best brush, and at the same time the very softest brush is the best brush under the same conditions. Nobody seems to know how the quality should vary with conditions, or where to bring that wide divergence of opinion down to a point. Who is better fitted to take that up than these institutions which are equipped for such experimental work and which have the time and inclination to find out the "why" of these things? That is simply another way in which we can cooperate, and where the technical schools might again be of advantage to the electric railways beside in the way of furnishing them the technically trained men whom they must have in the continuation of their operation.

President Beggs:— Mr. Sergeant, I had you down as one of the gentlemen to talk upon this question, as a man having put into practical operation such a plan; and coming from a section of the country where the higher education receives full recognition.

Mr. Sergeant:— I am only too glad to say a word or two on this matter. I was very much interested in Professor Norris' paper. I have been interested for a great many years in utilizing technical graduates so long as they could be prevailed upon to remain with us, but they are like birds of passage. They have done a great deal of good work for us for little or no compensation, and to a considerable extent in different departments, and some of them have sufficient sand to put on a blue uniform and go on the cars for a few months.

Now, it seemed to me in listening to this paper, Mr. President, that if one were to criticise at all it would be as to the brevity of the course in each department. I do not believe in a smattering. I think that this business becomes more specialized all the time, and that there is a good deal of danger in the young man who flits about from a couple of months in one department to a month and a half in another — there is a good deal of danger that he will think he knows it all in a year or two. That is the worst thing that happens to a young man. It doesn't matter to the company, because the company doesn't have to use that particular man if he has that proclivity, but it is a very bad thing for a young man. I think and in my experience I have concluded that when he gets to thinking there is nothing more for him to learn, that he then ceases to learn, but I would like very much to induce the student to spend more time in each department. I thoroughly do believe in the rotation from one department to another, and perhaps my criticism is not a fair one. I do think that we cannot have too many educated men in the business. I think one of our great things to do is to encourage the better education on the part of men who take care of motors and of the foremen of the car barns. We cannot afford to pay very high prices for foremen, but yet it is a splendid training ground for men in this business, if they can acquire a thorough knowledge of how best to take care of motors.

I cannot think of anything that affords more inducement to a man in the future in the mechanical line than that. Yet we have to put in a graduate and carry him along for a month or two, and he goes away and we stay on with our same foreman, who is very well in his way, but isn't educated enough. I am heartily in sympathy, Mr. President, with the movement to employ more technical graduates so far as it is in my power to get them and to keep them for the compenastion we can afford to give.

President Beggs:—Mr. Wyman, will you say a word?

Mr. Wyman:—Mr. President, I feel very much gratified at being asked to add a word upon the subject under discussion, though I think everything has been said that well could be. I will venture, however, to ask your permission to speak of a bit of personal experience in connection with this topic.

The firm which I represent, and which is largely interested in a number of companies, has during the past few years endeavored to secure men of technical training and to afford them an opportunity of the practical application of their acquirements in the field of street railroading or electric lighting. We have been fortunate enough to secure for what we call our "school," each year from ten to twenty graduates from Cornell, from the Massachusetts Institute of Technology and from a number of other technical institutions, and in the school at our home office in Boston we endeavor to give them some practical education by their employment in the investigation of actual statistics derived from the operation of our various companies. After perhaps a year's work of this kind, through which they gain a rather broad and general view of the principal lines of work in the railway and lighting business, they are sent for practical experience and education to some of the different companies we control and thus each year there are going to these companies to take quite subordinate positions students to the number of ten or twenty, so placed in their new posts of duty that they can follow the special line of their bent. If they are specially interested in electrical engineering they are placed in the engineering departments of the companies, or, if they desire to become general operators, they study in the shops, on the road, in the superintendent's office, or in the construction department of the companies. They follow a program which we have marked out for them and they are able in the course of two or three years to demonstrate their capacity and ability.

Having followed this practice for some time, we have been fortunate enough to secure a corps of men from whom we are drawing from time to time for the official make-up of our thirty or more companies, and some that started with us a few years ago are already superintendents, chief engineers and managers in the different cities in which we operate. We find that our method meets a very hearty cooperation on the part of the young men who undertake it and they are quite willing to start at the foot of the ladder and work toward its top.

I have been greatly interested recently in reading of the railroad course which the Chicago University is endeavoring to establish, and has already, I believe, begun. These practical courses which the technical schools and some of the universities are adding to their curriculum, I feel, should be aided and abetted by us in every way. There is nothing too good in the way of mental and technical equipment, when added to practical experience, that a man can have who is to direct the work of the public utility corporations which this association represents. The old method of doing work by rule of thumb no doubt oftentimes worked out very well, but the progress of electrical science and of general operation of railway and lighting companies requires of any one who would keep pace with the rapid advancement of this science, first, a technical training and then such training being supplemented by a practical application of its principles.

I want to add how heartily I agree with all that has been said with regard to this matter of technical men entering our ranks, and I hope the members of this association will assist and encourage work of this kind to the uttermost.

President Beggs:—We are very thankful indeed to the gentlemen who have so kindly responded in discussing this paper. Is there any other gentleman who has any suggestion or remarks to make?

Mr. Evans:—I would just like to refer to one point that has not been brought out in the paper by Professor Norris. It occurs to me that this scheme would fail entirely, or at least in part, if we had but one apprentice at a time. If the roads were sufficiently large to have several, I think very much better results would be attained. That comes from an experience I had early in my career, when I had charge of an establishment where I used to have from 25 to 30 apprentices, and we frequently found it necessary, in order to stir up the lagging fellow, to put the other ahead. If you simply appointed a man who was to be railroaded through this course to the general manager's office, he might reserve his best efforts until he reached the general manager's office.

While I have the floor, Mr. President, I would like to say that very much indeed depends upon the personality of the apprentice himself. I have made use, and recently, of some very valuable apprentices, as I have had only this summer as many as four in the shop. But it occurs to me, Mr. President, that these apprentices will fail in the first step unless they get down to the level of those with whom they associate. They must disabuse their mind of the fact that they are there to gain all and to give nothing, because Jack and Bill and Mike and Tom are not going to unbosom themselves very much to a fellow who impresses them with the idea of his great superiority. It seems to me, Mr. President, that this is a very important point with apprentices, and I simply mention the fact because it is a stumbling block upon which a good many fail.

PRESIDENT BEGGS:—I wish to endorse every word that Mr. Evans has said, from my experience with a number of such apprentices. They thought they were so above the men that they were thrown in to work with, they wouldn't put on the overalls and they were a little bit careful of their hands and garments getting greased. As soon as they do that they had better be transferred to some other department. The colleges should impress upon these apprentices, when they go out, that they should not set themselves up as superior to the men from whom they must gather the information they get to make themselves valuable.

MR. CORNING:—Mr. President, I should like to second the remarks of Mr. Evans, because I started in that way myself, and have observed the various results attained by men who began work in this way. Some started, apparently with the idea that they were headed for the general manager's office and would surely arrive, and they were to step only on the high places en route. Others seemed to think that they should do the best they could and give the best in them, in each position in which they were placed.

This brings to me an idea which I think it would be well for the technical schools to impress upon their students, and that is individual responsibility. Some men seem to think that responsibility is not to be expected of them; that this apprentice course has been mapped out for them and in passing through it they, by some hocus pocus, come out on top and are fitted to accept positions of responsibility. A fairly large number of men seem to have that idea and have failed to measure up to to what is expected of them.

MR. TINGLEY:—Mr. President, there is one thought that ocurred to me in listening to Professor Norris' paper. I assume, of course, that this is simply a tenative scheme. However, it appears to me that too small a period of time is allotted to the man in my department, namely, the accounting end. One of the greatest difficulties that the accounting department has is the inability of some of our technical men to grasp the importance of giving us any account of what they are doing, and unless a man has a turn of mind which lends itself to the grasping of accounts and accounting methods, two months is entirely too short a time to give him an insight into the details and working of a very important part of our business. Therefore it will greatly facilitate the man's education and also his efficiency when he passes out into the larger field if he is alloted a little longer time in that department.

There is one other thought, and that is that a man in this apprenticeship should not be passed on from one department to another until the head of the department in which he is working has certified that he is competent or that he has done the allotted work, the same as you would not pass him in a school until he had done satisfactorily the allotted work of his course.

Professor Norris:— It is a coincidence that Professor Richey is here to-day, because it was while I was indirectly associated with the Indiana Union Traction Company for a period of four months that I got the inspiration to prepare this paper. My experience bears out that of Mr. Richey — there are more students in our electrical railway course than in several others put together. Some years ago, when the association was reorganized, with the consent of the director of the college, we placed the laboratories of Sibley College at the disposal of the association, and I think every other technical school in the country would be glad to do the same thing. Regarding the brevity of the proposed apprentice course, I acknowledge that the amount of time allotted in each department is very small, and possibly eighteen months total time is too short. I think the steam railway companies require four years. My suggestion was made simply as an individual and not as a representative of any committee or anything of that sort, and it was made simply to get the matter before the association for discussion. Our schools appreciate the course which Mr. Wyman has described. Mr. Wyman's company sends a representative to Cornell to talk to the men, and it is difficult to find a room large enough to hold the men who want to listen to that representative.

President Beggs:— The next order of business is the paper on The National Fire Protection Association, by Mr. Ralph Sweetland, of Boston, Mass.

# THE NATIONAL FIRE PROTECTION ASSOCIATION.

By Ralph Sweetland, *Engineer*,
New England Insurance Exchange, Boston, Mass.

The National Fire Protection Association, as its name implies, is an association whose object is to promote the science and improve the methods of fire protection. It was organized in 1896 by men connected with stock fire insurance companies in an attempt to unify requirements for construction in new and old buildings, installation of automatic sprinklers and other fire appliances. It was soon seen, however, that if the association was to accomplish its mission, not only the underwriters but all national bodies having primary jurisdiction must be included in its membership. To that end, in 1904, its constitution was changed so that it now has as active members, the American Institute of Architects, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, American Street and Interurban Railway Association, American Water Works Association, National Board of Fire Underwriters and practically every insurance organization of importance throughout this country and Canada.

Its work might be described as the preparation of standards for so-called fireproof or fire resistive construction, slow burning construction and correction of buildings of inferior construction, especially as regards resisting the action of fire; standards for fire doors and fire shutters and wired glass windows; standards for construction and installation of all fire fighting appliances and apparatus, such as the automatic sprinkler; steam, rotary, centrifugal, or electric fire pump; hydrants, hydrant houses, hose, play pipes; chemical fire extinguishers; standards for signalling systems used for the transmission of signals affecting the fire hazard, such as thermostats, journal alarms, watchman's time recording apparatus and automatic sprinkler alarms; standards for the construction of ash cans, waste cans, safety cans for benzine, gasolene, etc.

As an example of the association's method of treating a subject, I might cite the course pursued before the standard for construction and equipment of "Car Houses" was completed. A committee to consider this subject was appointed early in 1905 and a preliminary report was submitted to the association in May of that year which, after being discussed, was referred back for further consideration. The committee worked on the matter during that year and again submitted a report in May, 1906.

This report, while fairly satisfactory, was not finally adopted and was again referred to the committee. During the next year, after our committee was practically agreed, a conference with members from your association was requested that the endorsement of this report by it might be obtained. This conference, as you are well aware, was held, a joint report has been agreed upon, the report adopted by the National Fire Protection Association, and will, I trust, receive the approval of this convention.

During the time that the matter was under consideration by the committee, the data obtained from numerous fires in car house property was gone over, engineers engaged in designing car storage buildings were consulted and numerous tests to determine the efficiency of the protection afforded by the so-called aisle line sprinklers were made.

Among other important subjects now receiving consideration I would call attention to the work of the Committee on Cement for Building Construction as this committee's work includes an investigation of concrete, a material coming into such general use not only for foundations, retaining walls and bridges, but also for building construction. Members of this committee, with representatives of the United States Government, various engineering associations, and the National Board of Fire Underwriters, arranged for extensive tests, which are being made by the Structural Materials Testing Laboratory at St. Louis. Owing to the non-completion of these tests and the importance of harmonizing differences with committees from the various National Societies, such as the American Institute of Architects, Society of Civil Engineers, the Mechanical Engineers and others, the report of this committee has not yet been completed. It well illustrates, however, the care which is taken by our association, not only to have our standards conform to what we believe to be the best practice from a fire point of view, but to have them accord with those recommended from other engineering societies.

In the preparation of a standard for the construction and installation of a particular device, such, for example, as the fire door and shutter, wired glass window, automatic sprinkler, etc., an immense amount of experimental work is necessary to determine the efficiency of the device under conditions as near actual as it is possible to obtain. That the tests and investigations may be uniform and that a direct comparison of the efficiency of particular devices may be made, it is necessary that these tests and investigations shall be done by experienced engineers, trained in the particular line of investigation in which the device would class.

For this purpose the Underwriters' Laboratories at Chicago, which are said to be the best of their kind in the world, have been incorporated and tests on these devices, especially as to whether they may create a fire hazard or serve as a fire retardant, are here made. After a particular device has been tested, the report goes to a committee of the association for final review and for vote as to whether it is worthy of approval or not. Take, for example, the tests which were necessary before the standard for a fire door or shutter could be decided upon. Numerous doors agreeing with the proposed standard were constructed, hung with regular hardware, subjected to a fire upon one side, the temperature running as high as 2000° Fahr., and then while the doors were hot, fire streams were played upon them, thus duplicating actual conditions which occur when a fire door in an opening to a building is subjected to a fire on one side with hose streams playing into the building and striking it.

In the standards for the construction and installation of automatic sprinklers, field conditions as near as possible, are duplicated, such as subjecting the sprinklers to as extreme a water pressure as would occur by severe water hammer; the effects of corrosion, as from the fumes of sulphuric or muriatic acid; the effect of loading, as when a sprinkler head is whitewashed or calcimined at the time the ceiling of the room is so treated; the distribution of water from the sprinkler under smooth or joisted ceilings and under varying pressures.

Again the hand chemical fire extinguisher, a device which is coming into quite general use for car storage houses, might be mentioned to show the detail which must be gone into before a standard for such a device can be issued. Not only the quality of the material, thickness of the shell, coating of the interior to resist corrosion, strength of the hose, nozzle, etc., but practically every detail of construction must be carefully gone into.

As soon as a standard for a particular device is issued, numerous manufacturers, who profess ability to make devices agreeing with this standard, request approval of their product. Here, again, the laboratory is called upon to test the particular make of apparatus as to whether or not it conforms in all essential features to the pre-determined standard.

Originally, after devices as made by a number of manufacturers had been checked up and found to agree with the standard, a list of such manufacturers was issued by the National Board of Fire Underwriters and circulated by the various underwriting boards and associations so that the public could ascertain in advance whether or not a certain manufacturer's device was or was not approved.

It was found, however, that owing to competition, while a manufacturer could make a device which would meet the requirements of the standard when submitted to the laboratories for test, the devices sold in the open market in many cases fell far short of the standard, even when it was known that samples would be obtained from the field, sent to the laboratories and tested. This led to the introduction of what we know as the Factory Inspection Service.

This inspection system has been applied to hand chemical fire extinguishers, fire doors, metal framed and wired glass windows, and is about to be applied to fire hose and numerous other devices. As this inspection service is carried on at the present time, an engineer connected with the laboratories, visits the factory of the manufacturer, checks over the material, the process and the completed article and a tag bearing a serial number and a statement that it is made under laboratory inspection, is then fastened to the article.

Consider again the hand chemical fire extinguisher, as this is a device which must be carefully and accurately made, since possibly months after installation it may be needed and must be free from corrosion, capable of withstanding a high pressure and must freely discharge its contents. A factory where any considerable number of these are being turned out is visited by the engineer two or three times a week. He notes the thickness of the shell, the coating of the interior surface, the attachment of the hose, the condition of the nozzle and the general character of the extinguisher after it is assembled. Tests are also made on a certain number of extinguishers which have been completed since the engineer was last in the factory and if any of these fail, the whole product is rejected.

This inspection service, as you will note, follows quite closely the inspection as carried on by the government for armor plate, guns, ammunition, etc. The cost of this inspection service to the consumer is nominal and is never applied where its cost is more than one per cent. of the selling price. With devices bearing these labels there is a reasonable guarantee that the customer is obtaining that for which he is bargaining.

Such, briefly, is the work which our association is trying to accomplish. In most, if not all, of this work you are necessarily interested for, with the large amount of property directly under your control, you are anxious to have it in such a condition that there will not only be the least liability of fire, but in case one occurs that the flames will be extinguished with as little trouble and inconvenience as possible, since, regardless of the money which you may collect from insurance companies, the loss in revenue due to the destruction of property is of very serious importance.

In closing I want to express what I believe to be the desire of our association and this is that you take an active interest in our work, not only by being represented at our annual meeting, but by serving on committees and assisting in promoting the best methods of construction and protection, that the enormous fire waste, amounting in the United States for this year to nearly $185,000,000 may be diminished.

## *Discussion of Mr. Sweetland's Paper.*

PRESIDENT BEGGS:—We are under obligations to Mr. Sweetland for the care in the preparation of his paper and for the points brought out. As Mr. Staats of Cleveland is here and has given a very great deal of thought to this matter we will be very glad to hear from him.

MR. STAATS:—There is very little I have to say except that in the first clause of Mr. Sweetland's report I notice that he mentions a great many leading associations which are members of the National Fire Protection Association, and then in the last clause he says practically every insurance association of importance throughout this country and Canada are included. Now that is covering some of the greatest underwriting institutions in America. I have reference to the Associated Factory Mutual Fire Insurance Companies of New England, and they should have been emphasized in this report, except that possibly the report comes from the stock insurance end of the line. Then I might add to this a stock insurance company, the American Railway Insurance Company which was the first organization to take steps toward promoting the interests of the electric railway and lighting companies. That company, as you probably know, is practically made up of the electric railway and lighting companies and you will probably hear more from that under the report of the chairman of your Insurance Committee.

Now regarding car houses and the equipment of the houses, I have the honor to be a member of the Car House Committee of the National Fire Protection Association and work in conjunction with Mr. Sweetland so that you see a mutual insurance man and a cooperative insurance man and a stock insurance man can work along the same lines if we have a correct understanding.

I believe I express the feeling of the convention when I say I am very glad to see the old line companies and their representatives coming a little nearer to the members of this association. I think that eventually it will prove a benefit.

The last feature to which I would make reference is the absence of anything that the National Fire Protection Association might offer in the way of reduced cost of insurance after all these appliances which they so strongly recommended have been introduced.

MR. SWEETLAND:—If there is no other member that has anything to say, I would like to reply to Mr. Staats.

It is true that I mentioned no insurance organization other than the National Board of Fire Underwriters, since I did not wish to mention some without mentioning all. This paper did not attempt to describe any particular form of procedure which would be necessary in order to reduce the insurance rate on a particular building or property, and was simply intended to interest the American Street and Interurban Railway Association, and its individual members, in the broad subject of fire prevention. The questions raised by Mr. Staats would be taken up by an insurance organization or company when a method of protection for a building was suggested.

President Beggs:— The next paper is by Mr. H. T. Campion and Mr. William McClellan, of New York. On account of the lateness of the hour, and at the suggestion of Mr. McClellan, this paper will be read by title only, provided there are no objections to so doing. There being no objections, it is so ordered and the paper will be printed in full in the annual proceedings of the association.

# THE INFLUENCE OF THE DESIGN OF RAILWAY STRUCTURES ON ECONOMY OF OPERATION.

By H. T. Campion and William McClellan,
New York, N. Y.

There is no doubt whatever that some of the finest engineering in the world has been done in connection with the larger power plants of the country, and the writers have no intention of criticising or discussing these more important examples of railway work. In traveling over the country, however, on various kinds of engineering business, one naturally sees a large number of the smaller plants. In many cases it is interesting to note the great ingenuity bv which money is saved and extraordinary results accomplished. The struggle for net earnings is so great and the intelligence of the average engineer together with the wide spread diffusion of information is such that one need not be surprised at the great effort which is made to reduce the expense to a minimum. But in spite of all this, it is almost pathetic at times to see the amount of effort spent in wrong directions and the neglect of very important factors of operation in the attempt to reduce minor ones which may be more obvious and outstanding.

Perhaps this neglect is found more frequently in connection with structures and their accessories than anywhere else. When a power house consists of an engine or two with only a few boilers, it seems as though any one can design it. The car barn may apparently be placed here, there, anywhere, so long as it is along the line of the road. The cars may be gotten out and into it in any fashion which occurs first to the person who makes the design. Presumably, the car inspectors will get the trucks from under the cars in some way, so no great effort need be made to do this quickly and conveniently. Reinforced concrete is somewhat new and desirable in many cases so that it is often used to the exclusion of steel, brick, and other materials whether it is most suitable and least expensive or not. These are only a few points indicating how the law of economy is violated.

The effect which the design of structures has on cost of operation is two fold: first, through maintenance charges; second, through convenience and adaptability in reducing the labor item. The writers know of several roads to-day, for example, which are operating an unnecessarily large total number of cars because too great a percentage of them are in the shop constantly. Cost of operation suffers here because of the increased fixed charges and, again, because of the large repair costs.

But the real cause is the lack of shop facilities. In many cases, this lack is due, not to actual want of room, but rather because the space is inappropriately utilized, or proper accessories are not provided.

In connection with the power house, coal and ash-handling furnish other examples full of infinite and frequently expensive variety.

The greater demand for liability, both for the public and the employes, has introduced a cost which can be reduced through proper attention to design of buildings and highway bridges. This is particularly so for the new high tension alternating roads. Finally, the matter of maintenance, really a large item in the cost of operation, is greatly influenced by the choice of materials.

As proof that these are facts and not fancies, it is only necessary to point to the great number of roads which are yearly taken under the control of large operating firms or companies. About the time these roads are taken over, they are tottering and about to fall. As soon as they are acquired, the strong engineering talent of the new company starts an extensive system of improvement. Many times it is carried out gradually and in such a way that the original owner with perhaps little money could have done it had there been sufficient insight and foresight.

The reasons for this apparent blindness are not hard to find. First, we have the almost total absence of any systematic recording or analysis of costs; and second, an utter lack of any proper idea of a provision for maintenance. There is no understanding of what a serious cost proper maintenance really is. If there were, greater efforts in design would always be made to reduce it to a minimum.

There is not space in such a paper as this to cover the whole ground of our subject. We shall merely give some more or less detached notes on these points which come up for discussion most frequently, particularly in connection with smaller systems, and where the answer is often not obvious or easily obtained and yet is of the utmost importance.

## MATERIALS.

Before discussing certain details of particular structures, it may be well to say a few words about materials in general, especially as there seem to be many erroneous ideas prevalent.

This may be called the day of reinforced concrete, not because other materials are not being used in large quantities, but because its introduction has been recent and the increase of its use very rapid. There seems to be a disposition on the part of all owners to try to find same excuse to explain why they have not found it advisable in certain cases to use reinforced concrete. We have of late frequently found men who apparently believe they are using some inferior substitute when building structural work with steel or wood. Yet it does not seem to be as well known as it ought that reinforced concrete has certain limitations and, although it is one of the most useful building materials ever devised, it is not applicable to all kinds of work.

In the first place, reinforced concrete is not beautiful in itself and, unless much money is spent in very elaborate centering and in finishing, it cannot be made attractive from the standpoint of aesthetics. The beauty of reinforced concrete lies in its solidity and its very apparent durability.

It is also very apparent that changes cannot be made in reinforced concrete buildings. Therefore, unless plans are fairly well determined for a building, it would not be advisable to build of reinforced concrete. It should be remembered that in destroying a reinforced concrete building there is little or no salvage. And frequently added expense to dispose of the material after it is taken down is necessitated.

The most attractive features about reinforced concrete are, of course, its fireproof qualities and the total absence of any maintenance charges. It must be conceded that these two arguments are very powerful and will warrant even some extra amount in the investment. The difference in cost, however, should be very carefully calculated and capitalized in order to see whether such extra expense as may be required is warranted. Maintenance charge on interior steel work is very small and for long spans such structural work costs less than concrete steel under ordinary circumstances. There may be certain conditions which may warrant using concrete for very long spans. The writers are now engaged in placing concrete roof girders over a span of seventy feet. These girders require no greater head than would a steel or wooden truss and, though eighteen inches thick, they will not look cumbersome owing to their great length. Concrete girders on such a span are only possible because all the material except cement is found right on the site.

FIG. 1 gives a view of a paint shop in which girders of forty-eight feet span were found much cheaper and entirely advisable under the circumstances. This span is not what would be considered a long span, however.

In view of the numerous accidents which have happened to concrete structures lately, it should be emphasized that there need be no hesitancy in using this material. It is necessary, of course, to exercise eternal vigilance as to the materials used and the method of placing. The cement, sand, and stone may be chosen under the best specifications and with the most rigid inspection, but this is no guarantee whatever that a good building will result. As nothing definite can

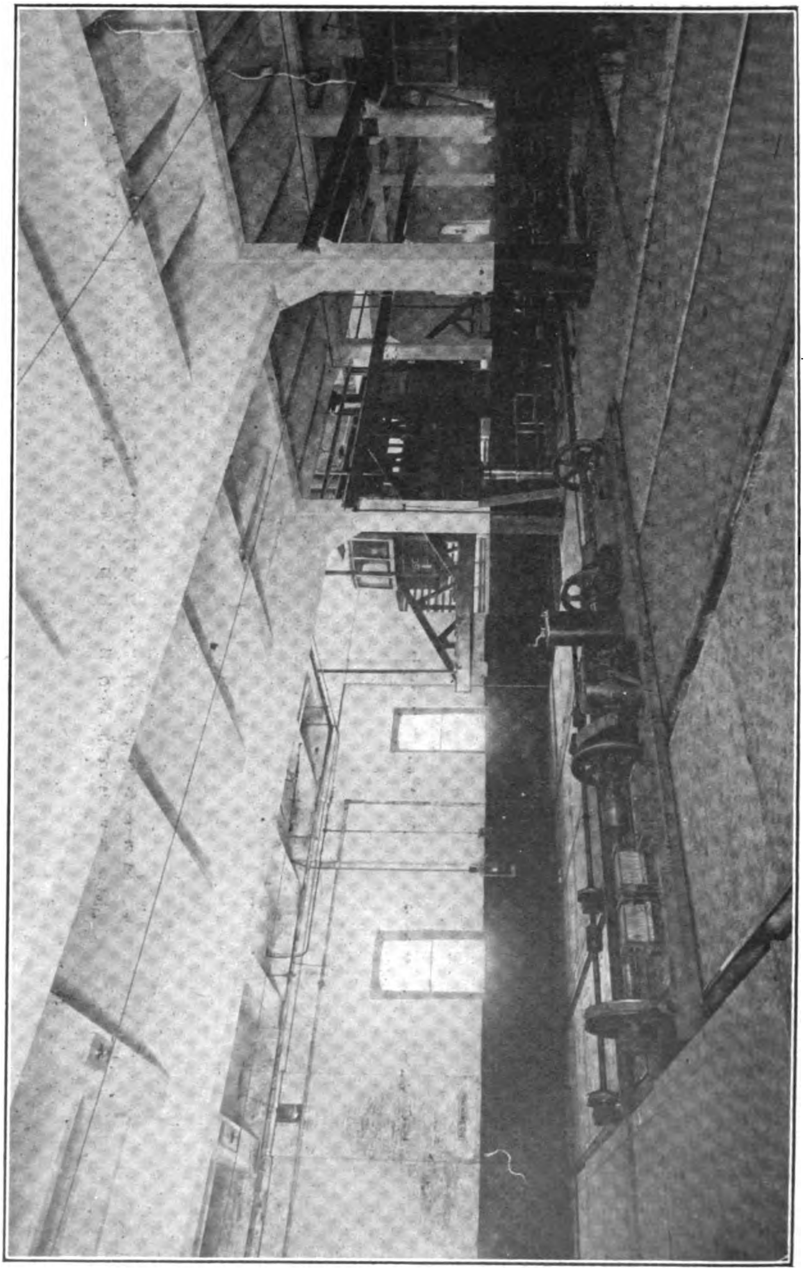


FIG. 1.— PAINT SHOP.

be determined by inspection after the removal of the forms, the inspection must be unceasing and rigid while the concrete is being placed. This feature must be considered as an inherent weakness in all concrete construction. It can be almost entirely eliminated by vigilance.

Another advantage which concrete has is its ability to take up vibration. No one need fear that even extreme vibration will cause anv failure in a reinforced concrete structure. This makes it particularly useful for highway and other bridges where its cost is not prohibitive.

In Fig. 2, it will be noted that the crane girders are made of reinforced concrete. These have been in use for several years and, together with numerous other examples, have shown that it is both safe and advisable to use reinforced concrete in such cases, where all other conditions will warrant it.

On the other hand, there are cases which will be noted where steel is more advisable and where concrete is really not applicable at all. In noting the advantages of reinforced concrete, the very definite advantages of steel should not be forgotten. It is very much less bulky which would be an argument where space is very valuable or hard to obtain. It is entirely unaffected by oils which are frequently found in connection with machinery and engines. It is for this reason that some persons favor steel for turbine foundations rather than reinforced concrete. Numerous experiments have shown that signal oil dripping on concrete soon causes it to lose its strength, and disintegrate. It may, therefore, be possible that concrete foundations under turbines might be seriously weakened if the lubricating oil dripped or soaked into the concrete to any great extent.

As a matter of fact, the joint use of structural steel and reinforced concrete is frequently the best solution of the problem — examples are shown in Figs. 3, 5 and 7. Around the engines and turbines, and for turbine foundations, this will usually be true.

## COAL AND ASH-HANDLING.

One of the features which has much to do with influencing the cost of operation and which is frequently neglected in the smaller plants is that of coal and ash-handling. Certain circumstances demand an overhead bunker with conveying apparatus while, under other conditions, pockets are more advisable. Where overhead bunkers are used, great care should be taken in the choice of type and material, as otherwise maintenance costs may be very high.

In the suspended, or catenary type, the structure requires frequent painting and, to insure a reasonable long life, a lining is demanded. This lining is usually built of concrete in which a metal mesh should be placed to prevent, as much as possible, the cracks which come, not only from temperature variations, but also from alterations in the shape of the structure due to load changes.

If long life and low maintenance are to follow, the effect of this alteration in shape due to change of load must be carefully looked after in design.

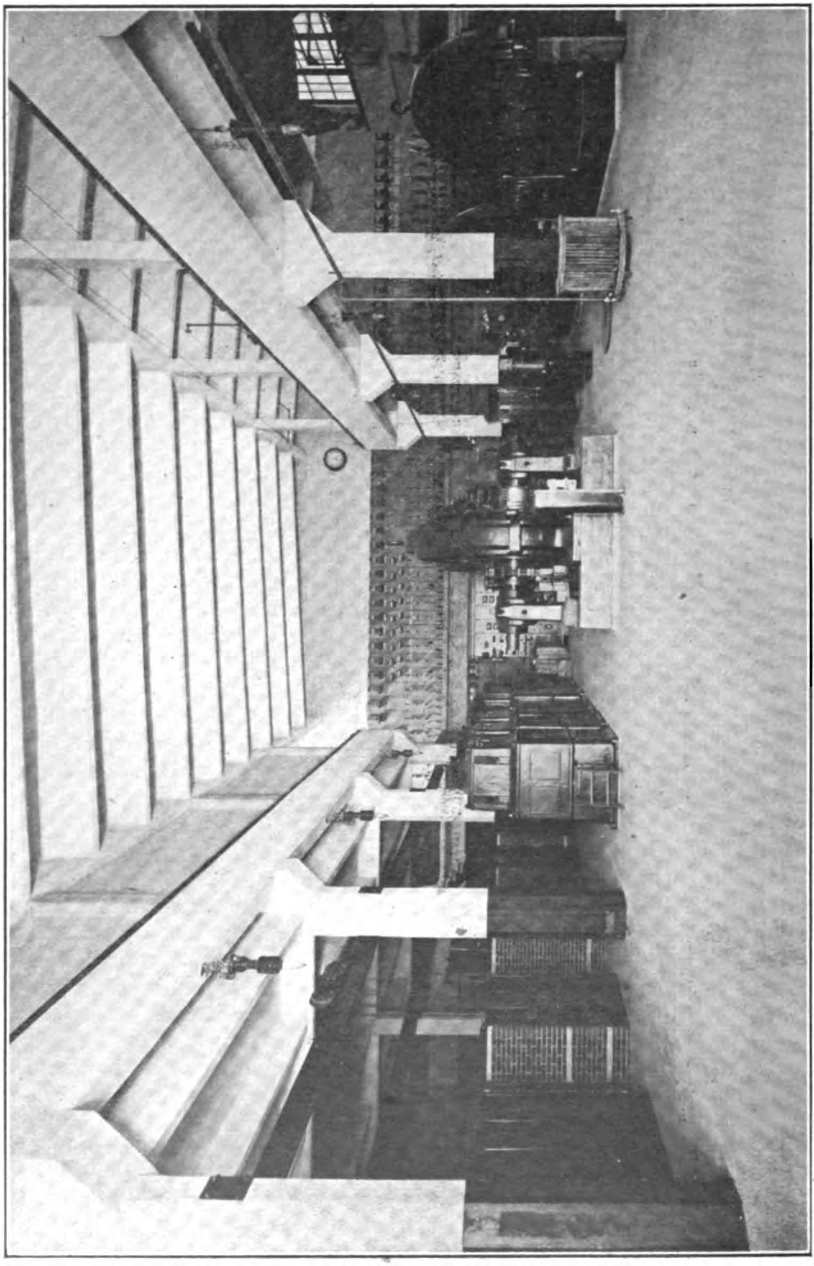


FIG. 2.— SUB-STATION INTERIOR.

Water draining over coal forms an attacking sulphurous acid. Should cracks and fissures develop in the concrete lining, this acid will enter, not only corroding the steel structure but also eating its way into the more porous concrete and possibly neutralizing its alkaline properties.

In the rigid type of bunker, we have other conditions to guard against. Fig. 3, shows a typical sketch of this type in which steel has been used for the main supporting members because the loads, or their resulting movements, are so great as to make the entire use of concrete inadvisable on account of the great bulk necessary and the expense entailed by its added dead load on the foundations of the structure. The principal risks to be guarded against is its tendency to crack from temperature changes, opening it to the dangers enumerated in the case of concrete linings of steel bunkers, and, furthermore, causing unsightly leaks in the boiler room. There is also the abrasive action of the falling coals on the surface of the concrete.

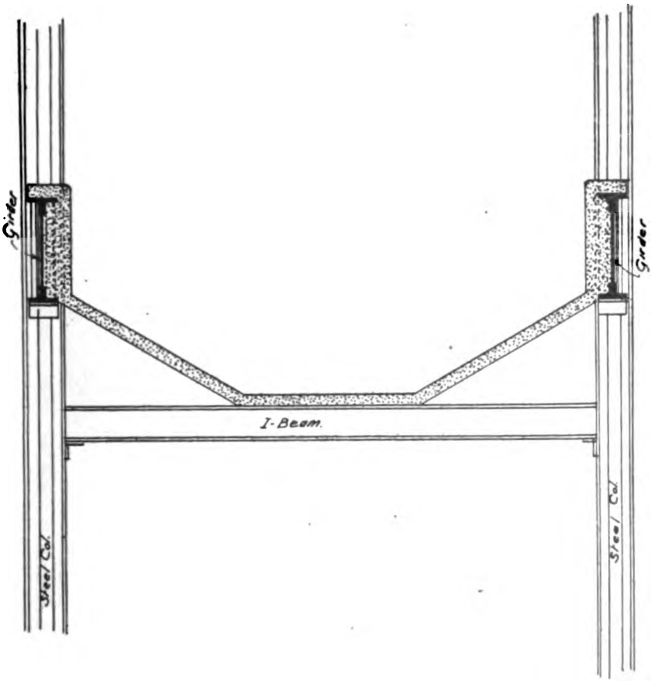


Fig. 3.— Steel & Concrete Coal Bunker.

The last item can be guarded against by applying to the inner surfaces of the structure a hard, well rubbed granolithic surface which, if properly applied, will resist such abrasion as a comparatively soft material like coal will cause.

The first objection, temperature cracks, can and should be taken care of in the design. The units of the structure should be in short lengths and a water-tight joint can be provided in a number of ways. Fig. 4 shows one simple and effective way of making a joint.

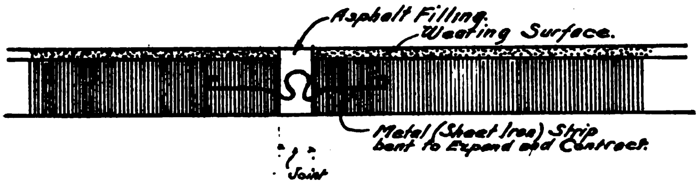


FIG. 4.— WATERPROOF JOINT.

It is difficult to give any accurate comparison of costs of the two types of bunkers. There is, of necessity, great variation owing to difference of size, design, and amount and kind of coal passing through. The life of the unlined bunker with average coal will be, perhaps, eight

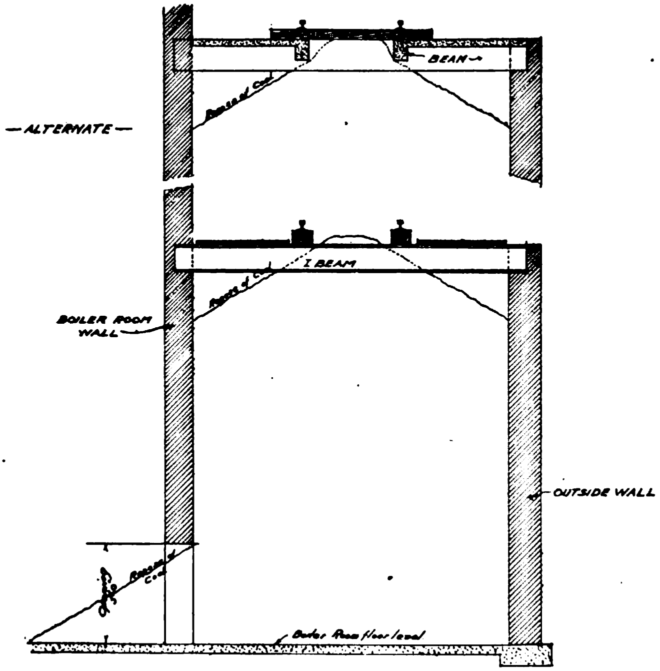


FIG. 5.— COAL POCKETS.

to ten years. The writers took down one and found, by drilling, the metal shell reduced more than one-half in thickness in this time. Maintenance on the rigid concrete type and on the lined catenary type

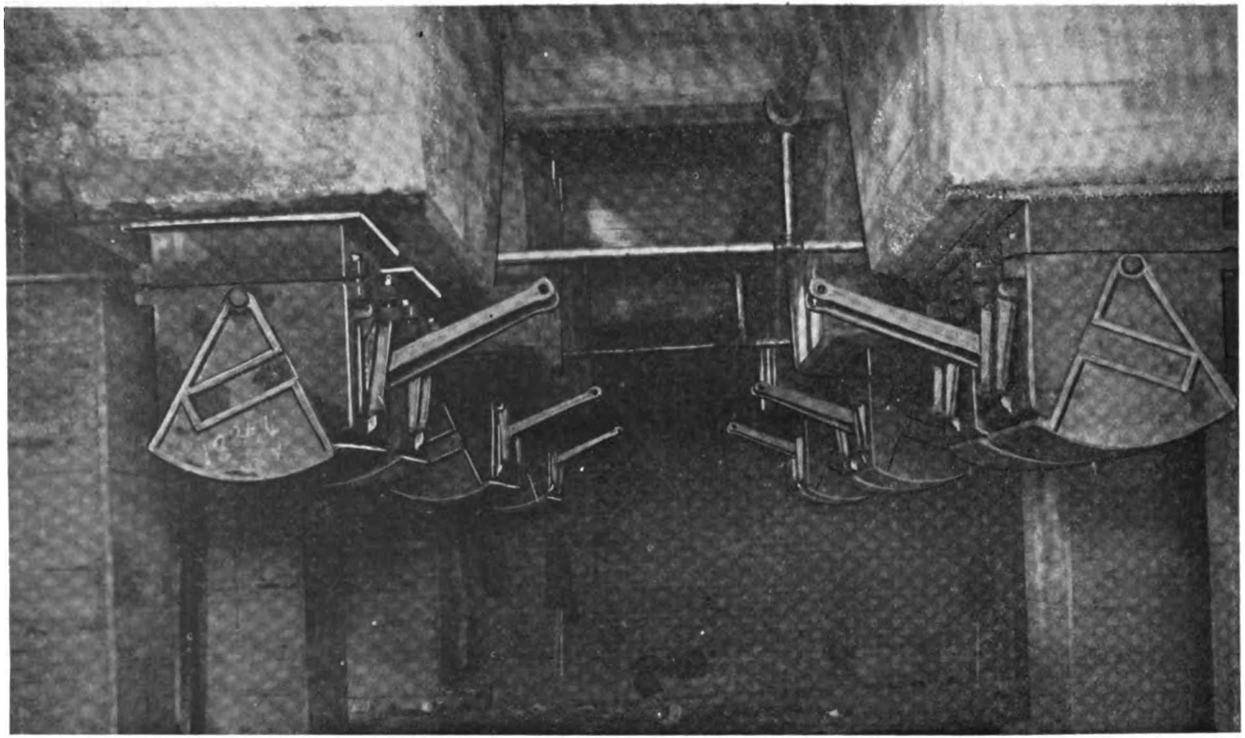


FIG. 6.— SUSPENDED CONCRETE ASH PITS.

is practically zero, though the rigid type has somewhat the advantage. Depreciation on the rigid type and concrete-lined type is practically zero.

What is more surprising, however, is the great lack of attention given to economical handling of coal for hand-fired boilers. We must pass this with only a word. Frequently an overhead bunker is advisable. If not, the scheme shown in Fig. 5 is very useful and inexpensive. A series of bins is built using the boiler room wall for one side. The illustration is self explanatory.

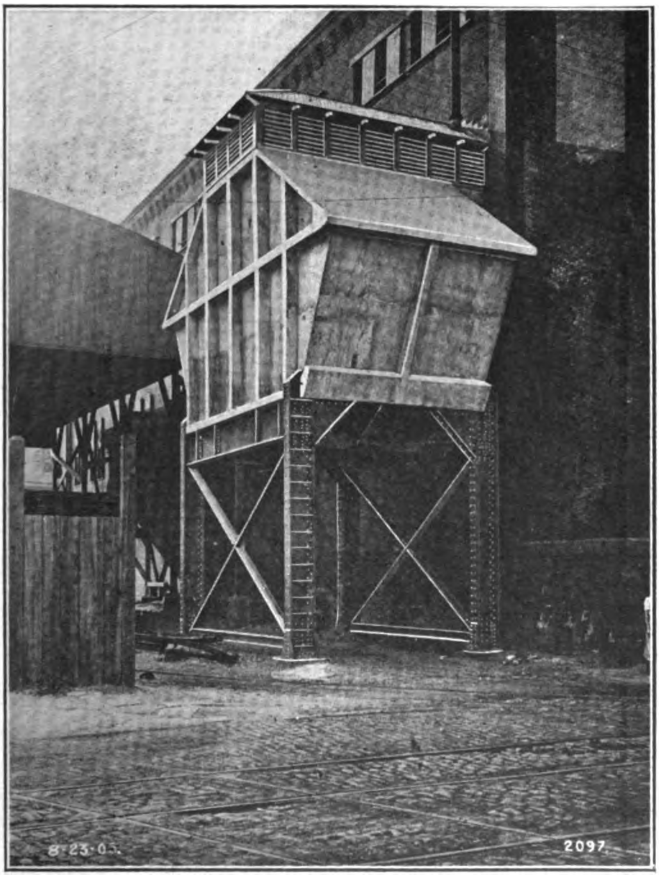


FIG. 7.— STEEL AND CONCRETE ASH BIN.

In the handling of ashes, there often could be much improvement.

Where the ashes drop directly underneath the boilers, pockets can be most effectively and economically constructed of concrete and made a part of the boiler room floor structure as shown in Fig. 6, leaving a comparatively clear basement for the handling of ashes, either by the industrial railway method or by some conveying scheme.

In some cases, pockets of this description have been lined with fire brick but the temperatures are so much under the point where concrete loses its water of crystallization that it seems an unnecessary expense to spend money for this purpose.

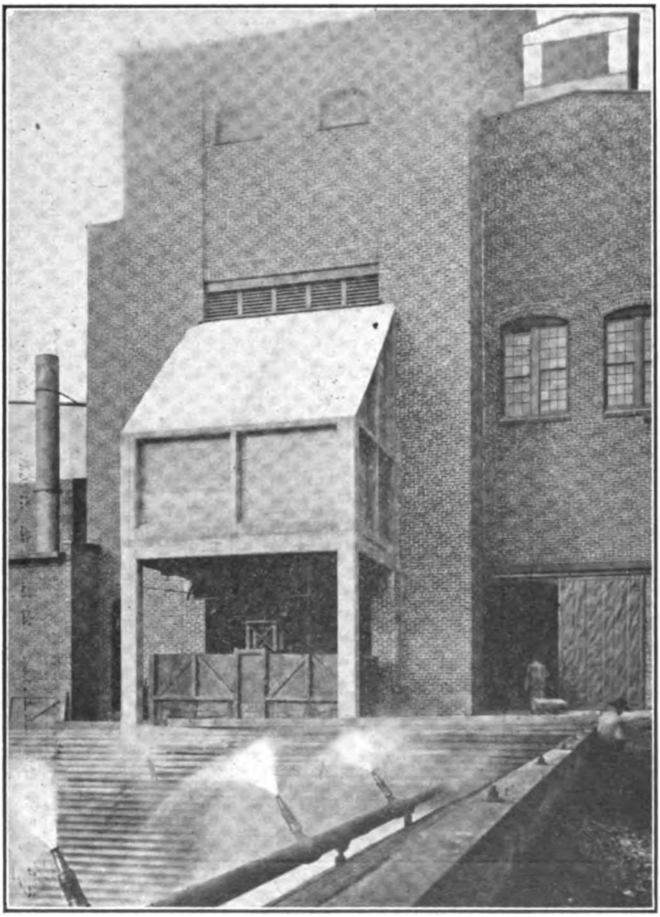


FIG. 8.— CONCRETE ASH BIN.

In building in the cast iron gate frames, care should be taken to set them in two or more pieces, for if they are set in in one piece, their expansion will certainly cause serious cracks in the concrete pockets.

In storing ashes removed from the boilers for final disposal at such times as best suit the operating conditions of a railway, reinforced concrete ash bins have been almost universally adopted on account of the fact that metal structures are not only costly but have a very short life under the trying duty of containing coal ash with its high percentage of corrosion acids.

These concrete structures, too, can be arranged in so many ways to suit local conditions, that they meet requirements which no other material could. Their cost varies considerably on account of location, height, and ratio of wall, floor, and roof area to cubical contents, but a range of from 30 to 50 cents per cubic foot of contained area will cover most cases. In large structures, the price may be even lower, but as no maintenance of the structure is required, the first cost is the last cost.

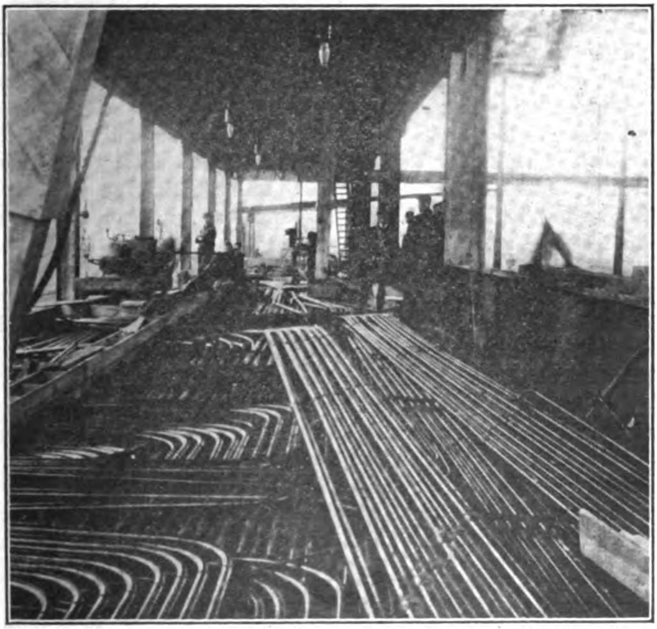


FIG. 9.—DUCT TO BE CONCRETED IN FLOOR.

Fig. 7, shows one of these bins made of a combination of structural steel and reinforced concrete, while Fig. 8 shows a bin made entirely of the latter material.

### SUB-STATIONS.

So far as operating costs are concerned, little can be said on substations as structures. They have received much attention and are, on the average, very well designed. Concrete has been used much and advisedly. It is expensive, however, to use monolithic concrete for bus bar compartments. Brick with either stone or concrete slabs is much better. Concrete is verv useful in floors, however, and frequently serves to dispose of the loricated duct problem cheaply and effectivelv. Fig. 9, illustrates its possibilities for this purpose.

### CAR BARNS AND SHOPS.

As remarked before, many roads have an unwarranted investment in rolling stock simply because of inadequate shop facilities. Steam roads have proven in the past — and are doing so yet — that low operating costs mean good shop facilities. By the latter term are included facilities provided for "road repairs" as well as for "shop repairs." Care for both classes is absolutely essential to success in operating and in this feature alone, more roads fail than in any other.

"Road repairs" are naturally made at the barns, while "shop repairs" are made at some centrally located plant. These buildings should be located and designed relatively to each other so as to provide the greatest usefulness. It is true that an electric car has no strict "stage" but can go on indefinitely with very brief or no layovers. Nevertheless, this is not a practical method of operation. Cars must be taken off for thorough inspection at regular intervals. This inspection, however, should take as little time as possible, and the shops and barns should be located so as to make this possible. No rule can be given. Simply keep in mind that every hour a car is kept in the shop unnecessarily means loss.

The car barn and shops should be absolutely fireproof. This will be appreciated when it is remembered that cars are largely inflammable and fire usually causes total destruction. In addition, there is always a comparatively large amount of inflammable material around with workmen carrying on operations which require heat or flame. Finally, we have the numerous chances for accidental arcs. At present, reinforced concrete is most popular and will probably remain so. Other materials serve very well, however, and local conditions will frequently prove them more advisable. It is interesting to note the following approximate costs of different types drawn from experience:

| | Per sq. ft. |
|---|---|
| Timber barn, two-track bays, sides covered with corrugated iron .............................. | $0.55 to $0.70 |
| Timber barn, three-track bays, brick or stone walls.. | 1.10 to 1.30 |
| Fireproof concrete barn, three-track bays, concrete or brick walls.................................. | 1.25 to 1.50 |
| Clear span steel roof, eight to ten tracks, brick walls. | 1.40 to 2.00 |

The cost of barns is often needlessly increased by including much special track work in the covered barn space. Even transfer tables can usually be left outside the barn proper and their cost reduced.

In shops particularly, the space should be nicely proportioned and there should be no backward movement in the progress of the cars through them. For convenience, we may divide a shop plant as follows:

1. Inspection shops with pits and standing space in rear.
2. "Jacking-up" shop with carpenter, machine and blacksmith shops close by.
3. Paint shop.
4. Erecting shop with pits.

The inspection shops with pits should be ample to receive cars as they come in. The standing space is provided back of the pits so as to allow the superintendent to properly distribute his work among the different shop departments.

The "jacking-up" shop should be well provided with facilities for removing trucks from cars. For this purpose no device is quite so useful as a double crane of sufficient capacity to raise the whole car body in one lift. We shall some day provide for this lifting in the design of the car body and thus avoid even the necessity of slinging the car for lifting.

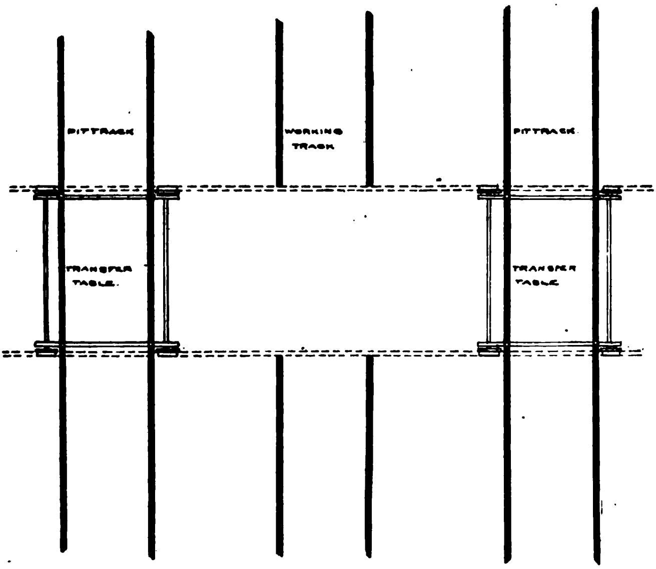


FIG. 10.—TRUCK TRANSFER TABLE.

Trucks are usually removed from the end but this is due more often to custom than to the best method. Fig. 10 shows a method by which trucks may be removed from the side by means of a small transfer table. This is especially useful where jacks must be used and where pilots are not easily taken off. It will usually be necessary to raise the car only a few inches to disengage the center bearing. Space will frequently be saved and the time much reduced. It will be very available in small combination barns and shops. It is also

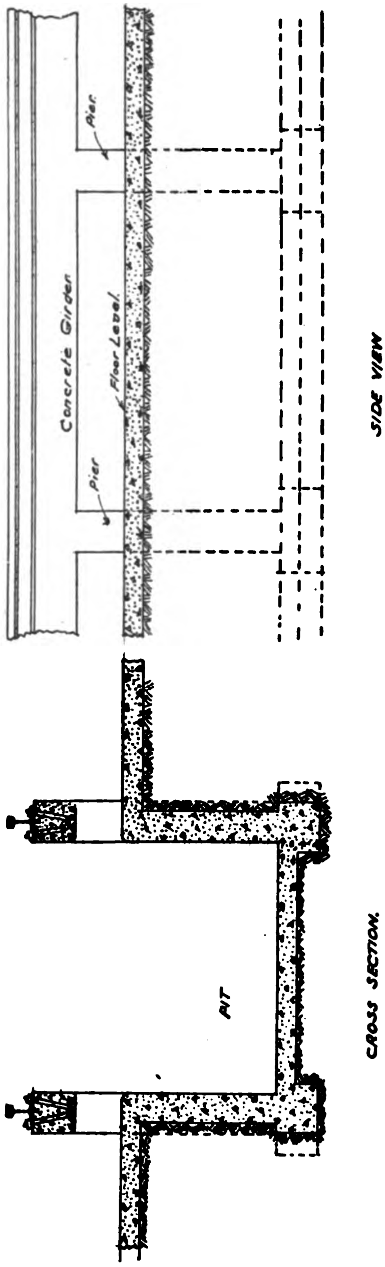


FIG. 11.—CAR PITS.

especially useful for emergency repairs. Moreover, such a device will become almost necessary in barns on high tension systems for the purpose of removing transformers and other heavy pieces. It was for such a purpose that it was first designed by one of the authors.

The paint shop should be in close proximity to the carpenter shop though paint-mixing should be done in a well guarded — perhaps a separate room. Ample space should be provided for the cars while drying, the time for which varies greatly according to the finish.

There has been much discussion on pits but the last word has not been said. Time will be saved by making the pits communicating instead of independent. They should be deep enough to allow a man to work without stooping. Fig. 11 shows a type of construction that is very convenient. It provides ease of working on the car both from the floor of the barn and from the pit. It is very useful in adjusting or replacing brake shoes.

The lighting in pits is usually inconvenient and insufficient. Fig. 12 shows a pit lighting unit which, placed every twenty feet staggered on both sides of the pit, gives adequate and effective lighting. Extension cords are provided for without extinguishing the general lighting.

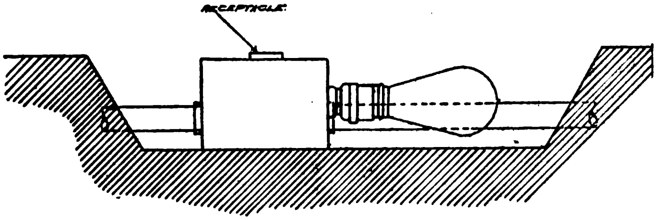


FIG. 12.— PIT LIGHT.

STORAGE BARNS.

Proper storage of cars is necessary if costs are not to be increased. Three types of barns have been used.

1. Open barn in which the office, sand compartment, and perhaps small repair shop are enclosed. Generally the cars are entirely in the open.
2. The semi-enclosed barn in which a roof is supported by posts with walls reaching perhaps 6 to 10 feet above the track, the entire front or entrance end being open.
3. The closed barn made up of 4 to 9-track units separated by division walls. The entrances are closed by rolling or sliding doors.

The semi-enclosed barn seems to answer all requirements except, perhaps, fire protection from the outside. Steam men have stored their cars outdoors always, but electric men have usually wanted a roof. This is, perhaps, necessary on account of the equipment, and because they frequently go into service on emerging from the barn without first standing in a closed terminal.

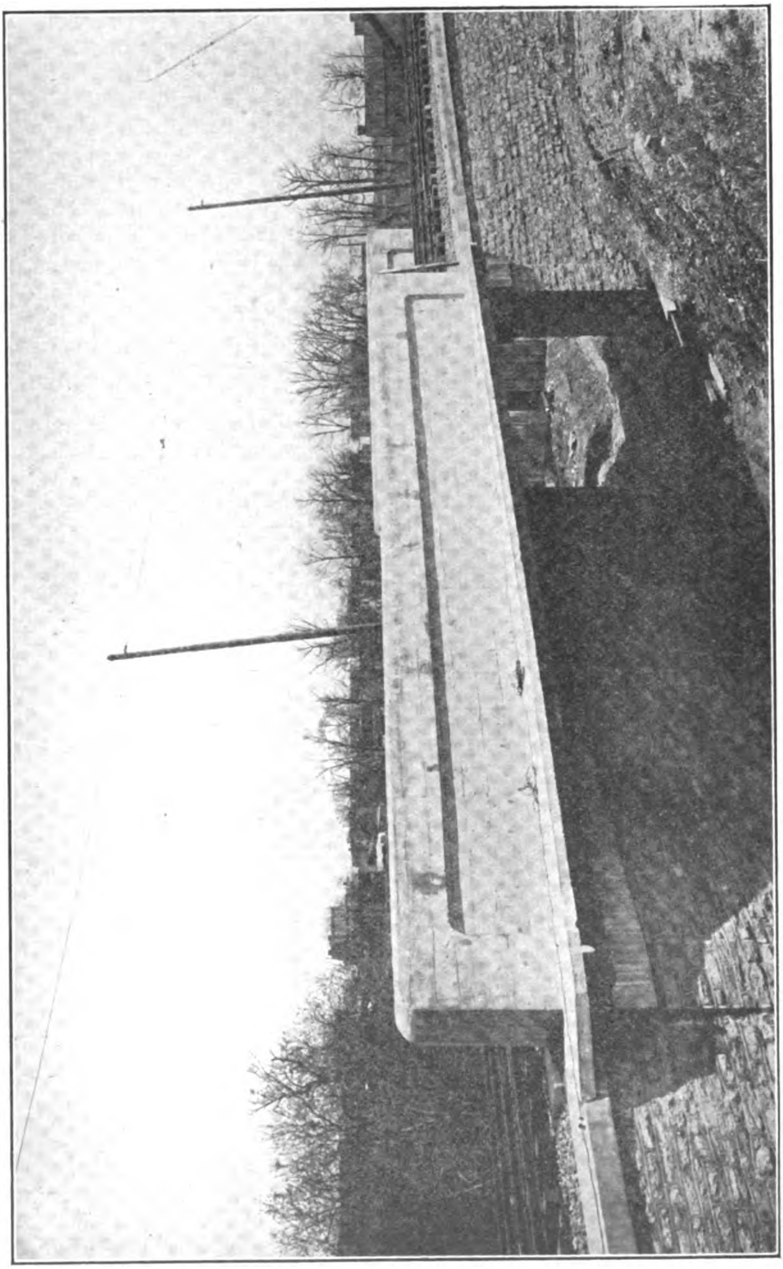


Fig. 13.— Highway Crossing.

The final structure that has a great influence on cost of operation is the grade or highway crossing. It is surprising how fast we are learning how much we can save by abolishing grade crossings. There are many types in use, but the most available material is concrete. The first cost is usually low, the maintenance is nothing, and the depreciation is zero. Fig. 13 (page 142) shows one very good example.

In all new roads, a constantly growing proportion of the estimate is for such highway crossings. The cost of a single accident is frequently enough to pay for several such crossings. The argument is plain.

PRESIDENT BEGGS:—The convention in the absence of any order will stand adjourned until 9:30 o'clock to-morrow morning in the sun parlor near the outer end of the steel pier.

The convention then adjourned to 9:30 A. M., of Thursday.

## THURSDAY MORNING SESSION.

### OCTOBER 17, 1907.

The second session of the convention was called to order at 10 o'clock, in the sun parlor on the steel pier.

PRESIDENT BEGGS:—The first order of business is the appointment of a nominating committee. I will appoint as members of the nominating committee Mr. W. Caryl Ely as chairman, Mr. C. S. Sergeant of Boston, Mr. A. E. Lang, of Toledo, and any additional past presidents who may be present at the session. My purpose in appointing past presidents as the members of this committee is that they know what the requirements of the association are, and the responsibilities which devolve upon its officers.

The next order of business is the Report of the Committee on Promotion of Traffic. If there is no objection, this report will be presented later on in the session and discussed in connection with the papers on Advertising and Publicity. There being no objection, it is so ordered.

The next order of business is the report of the Committee on Rules for the government of motormen and conductors, of which committee Mr. E. G. Connette, of Worcester, Massachusetts, is chairman. Mr. Connette is present and I will call upon him to present the report.

## REPORT OF THE COMMITTEE ON STANDARD CODE OF RULES.

*To the American Street and Interurban Railway Association:*

GENTLEMEN.—Your Committee on Standard Code of Rules respectfully reports that data sheet No. 18 was sent out to the various members of the association, as well as to companies which are not members, asking for the following information:

1. Company.
2. City.
3. State.
4. Urban or interurban system.
5. Have you read the report of the Standard Rules Committee which was submitted to the convention at Columbus, Ohio, October, 1906?
6. If so, have you adopted these rules as standard on your lines?

7. If you have not adopted these rules as standard, would you kindly give the committee your reason for not doing so?

8. If you have not read the report of the committee, will you please send for a copy of the report to the secretary of the association?

9. Have you any suggestions for the consideration of the committee relative to the report submitted at Columbus?

10. Remarks.

A large number of these data sheets were filled out and returned and your committee is pleased to report that a large number of the members of this association have adopted the standard rules, with such additions as local conditions required. A few companies have used the standard rules as a basis, but have not followed the recommendations of the committee in regard to preserving the integrity of the numbers, etc., as recommended in the report submitted at the Columbus convention. Three of the larger companies report that they have not adopted the standard rules; one of which does not give any reason; another gives as a reason that it has its own book of rules; the third states that it has a supply of rule books on hand and considers that its rules are suitable for local conditions, but that it favors standard rules as far as practicable. Another company reports that it has not adopted the rules, because they do not provide for a joint use of tracks by steam and electric trains. This, of course, is an unusual condition, which the committee has not yet considered.

Very few suggestions have been submitted for consideration. The committee, therefore, can only report progress as to further recommendations and that the matters now under consideration be taken up by the committee appointed for the ensuing year to consider this subject.

Respectfully submitted,
E. G. Connette, *Chairman,*
E. C. Faber,
E. J. Ryon,
J. N. Shannahan,
*Committee on Standard Code of Rules.*

## *Discussion of the Report of the Committee on Rules.*

Mr. Connette:— Mr. President, I would like to add to this report that there is one concern which controls a large number of properties which has its own book of rules, and that book of rules has been adopted on all of its properties. Then there is another holding company which controls perhaps six or eight different properties. They are members of this association, but they have adopted their own book of rules, and do not seem inclined to change. The Central Electric Railway Association has taken our book of standard rules practically as a basis for their rules, and has used them as far as it saw fit, but has gotten up a book of its own, claiming that there are a great many conditions existing among its companies which our book of rules do not cover. The New York State Street Railway Association has practically adopted our standard rules, and they are in effect in a large number of cities in the State of New York. Now it seems to me that the work of this committee for the ensuing year should be to make an effort to have a conference with representatives of these two companies, and also with representatives of the Central Electric Railway Association, to see if there is not some ground upon which we can reach a conclusion that will result in one standard book of rules.

President Beggs.— I would like to supplement what the chairman of the committee has said. We have two very large systems as well as a number of independent smaller ones in various sections of the country, and, while urgently desiring a set of standard rules, we have not adopted these rules, nor have we had any new rules printed for the last two or three years, anticipating just such a result as Mr. Connette has now stated.

(On motion, duly seconded, the report of the committee was accepted.)

President Beggs:— The next order of business is the report of the Committee on Heavy Electric Traction. The chairman, Mr. Calvert Townley, of New Haven, is not present, but is expected here to-morrow. If there is no objection, the presentation of this report will be deferred until that time. There being no objection it is so ordered.

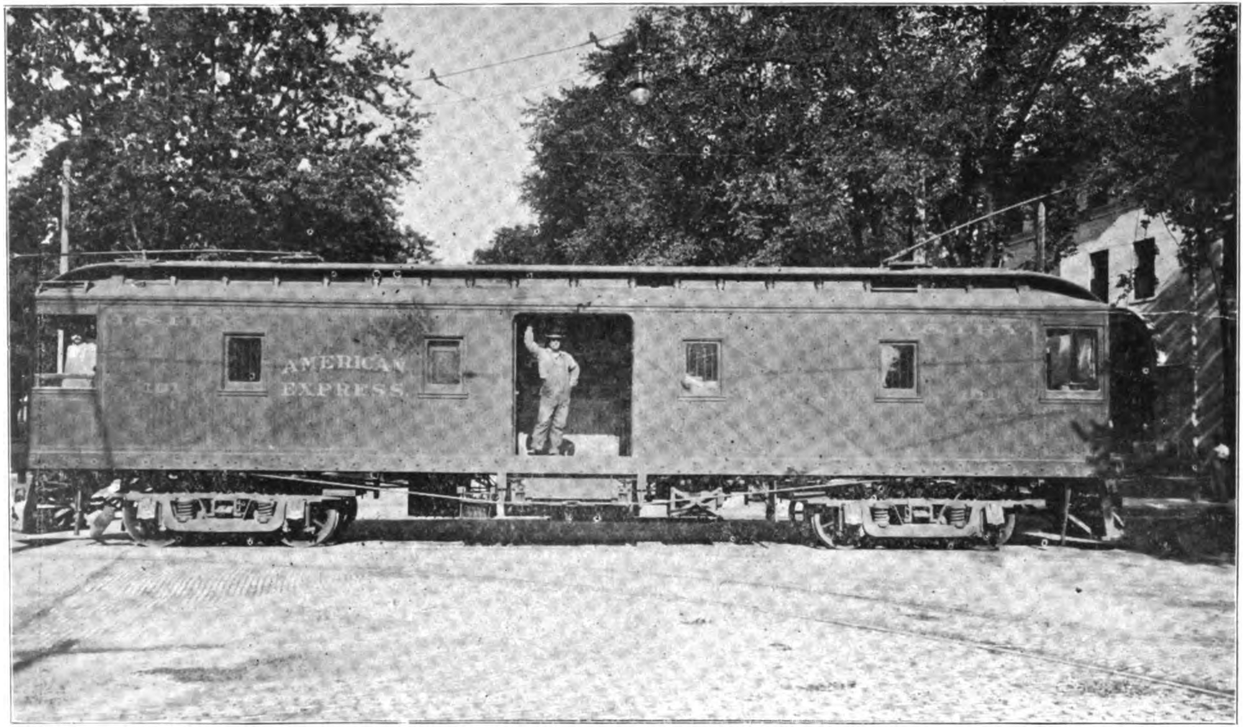
The next order of business is a paper by Mr. P. P. Crafts, of Clinton, Iowa, entitled "Light Freight Handling on Electric Lines," which will now be presented by the author.

## LIGHT FREIGHT HANDLING BY ELECTRIC LINES.

By P. P. Crafts, *General Manager,*

Iowa & Illinois Railway Co., Clinton, Ia.; Joplin & Pittsburg Railway Co., Pittsburg, Kan.

This subject has been discussed pro and con for a number of years, in fact, ever since the interurban railway became a realty; that is, after it branched from the confines of the so-called urban railway. Although



Modern Electric Express Car.

some of the older and slower roads began to conduct a so-called express business several years ago, the freight carrying field was not entered with spirit until the modern high speed road, built on private right-of-way, with heavy construction, was developed. It was then discovered that the interurban could not only compete with the steam roads and express companies, but that, due to its frequent and reliable service, it could also develop a freight business that could not have been developed by them.

To be sure a number of the earlier roads have charters which do not admit of their carrying freight or express but, on the other hand, the managers of many roads, although unhampered by such restrictions, have not given the subject the attention which it deserves.

As a result of the errors made by the earlier roads, coupled with their faith in the final outcome of a concerted and careful campaign, some of the newer high speed roads in the Middle West made a start. To-day, it is a common thing to read of interurban railways financed and constructed with a view of handling freight as well as passenger traffic, as it is now becoming an important factor in the earnings.

Where parallel steam competition exists, interurban managers should not be discouraged for shippers will favor the road which gives them good passenger service, provided, of course, rates are equalized and proper attention given to that branch of the business.

Generally speaking, it is a mistake to assume the position that freight will be carried only as an accommodation to your patrons, and then charge an exorbitant rate or neglect to ship promptly, or to take proper care of the shipment after arrival at its destination. On the other hand, many managers, in their anxiety to build up a profitable business, have oyerloaded their roads with expensive handling facilities, such as costly freight depots, intricate accounting systems, free team deliveries, etc., which have eaten the profits that might otherwise have been realized.

For that reason, it is sometimes a mistake to charge a higher tariff on passenger cars than is charged on freight trains; rather say to the shipper that you will handle his small rush shipments, on passenger cars when possible, at the regular rate, as an accommodation, so long as he confines himself to the freight trains as far as possible. It is very gratifying to the average shipper to know that the road upon which he depends will accommodate him when he gets caught short of some commodity, or that his profits will be increased by being able to obtain quick shipments of perishable goods. This also induces him to carry a smaller stock of staple articles, the result being that the road gets the benefit of a larger number of shipments at the minimum rate, which is in fact the most profitable part of the freight business, except in car-load lots.

Whether or not a freight business will be profitable depends somewhat upon the following conditions:

1. The population served outside of the main terminal and its dependence upon that terminal as a trading center.

2. The proximity of other trading centers to the population served outside of the main terminal, and the railway facilities tending to attract business away from the main terminal.
3. Steam trunk line connections leading to the main arteries of commerce and the ability of interurban roads to establish joint rates with them.

A full exposition of the third condition cannot be given without consuming too much time. In general, however, an interurban road with proper freight handling and terminal facilities, which offers quick and efficient service, together with joint rates with some trunk line, in competition with other trunk lines operating between competitive points may reasonably expect a fair division, or a greater portion, of the freight traffic. As stated earlier in this paper, shippers desire the best service with lowest rates, but, assuming rates to be even, shippers are generally favorable to the roads which provide good passenger accommodations; consequently the interurban roads reap the reward of frequent passenger service.

Owing to the antagonistic attitude of the steam roads, however, it is generally difficult to establish joint rates except where competition does not exist between them, unless connection may be made with some competing road which disregards the pooling or territorial agreements.

Let us trust that the day is rapidly approaching when the national and state commissions will take such action as will induce our larger and more powerful brothers to recognize the despised interurban. The progressive and agressive attitude of the interurban managers, if continued, will exert more influence in that direction than anything else that can be done.

Interurban freight traffic may be properly divided into the following classes:

1. Strictly light packages, transported only in baggage rooms of passenger coaches, at express rates or at a fixed charge per package or per hundred pounds, regardless of class, and generally termed express business.
2. Less than car-load freight transported on fast baggage cars at regular freight or special tariffs under regular or special classifications, generally the former.
3. A combination of class two and the haulage of a few local car-load shipments daily at regular tariffs and classification.
4. Regular car-load tariff hauled by steam or heavy electric freight locomotives at regular tariffs and classifications. Or any combination of the above mentioned classes.

Depending upon local conditions the freight traffic of a road may be confined to any one of these classes or it may be started in the first class and grow to the fourth class. As the fourth class will be discussed in another paper, I will treat only the first three classes, particularly the second class.

A freight business of class one may be conducted at small expense and is of material assistance in the earnings of a road. The freight carried consists generally of packages easily transported in baggage compartments of passenger cars, which are usually empty except for a very few trips per day. Usually no extra office force is required, the only expense being for stationery, books and possibly a small storage space at the main terminal. In some cases, when the charges are a certain rate per package, regardless of weight within reasonable limitations, a proper system of tickets dispenses with way-bills, expense bills, etc.

Inasmuch as the majority of freight-handling interurban roads come under the head of class two, that part of the paper will probably be of interest to the greater number of managers, so I shall enter into greater detail in handling the subject.

Interurban roads which conduct their freight business under the head of class two more nearly approach operating conditions parallel to the time-freight business of steam railways. The ability of the interurban roads to make fast time and to deliver at highways, farm crossings and warehouse or store doors is an inducement to either the shipper or the receiver, which assists in obtaining the business. Being usually restricted, however, to a narrow car similar in appearance to a passenger car, due to operating over city streets, an interurban road has limitations of its freight earning capacity.

The profits of such a business depend largely upon the opportunity of the management to secure combined freight and passenger depots at the terminals and in the larger local towns, so that extra labor in billing and handling at stations may be avoided, upon the charges of terminal city railways for the right to haul freight over their tracks, and upon the hour of day when freight may be delivered to receivers.

Generally speaking, the margin of profit in this class is close and only careful management will produce a profit, particularly during the first few months after the business is started. Expenses must be carefully watched and attractive freight houses and convenient hauling facilities at terminals sacrificed for something which costs less to maintain.

Damage claims must be very carefully handled, and to that end it is advisable to adopt some system of billing and accounting which permits a shipment to be easily traced from its starting point to the final destination. Some interurban roads have adopted simple billing systems, requiring only one writing to make the receipt, way-bill, expense bill and office copy. Such a system however, does not permit of proper checking, particularly if merchandise is transported over more than one road.

After an interurban road enters class two, a good local commercial agent is a necessity. The business, consisting of a great number of small shipments, requires constant development and care, particularly if competition exists. A live commercial agent, who is a good street man, and not a desk man, earns his salary many times over, particularly if he understands how to deal with shippers. The business obtained depends considerably on the personality of the commercial agent.

I fear that many managers, in charging expenses to the freight business, do not give proper consideration to such items as additional clerks, printing and stationery, insurance on goods in freight houses, a proper percentage of the receipts to cover loss and damage, power for freight cars, proportion of track and line maintenance, telephone service, interest on the freight handling investment, etc. Neglect of these items deceives the manager as well as his stockholders, and unless receipts grow beyond the safe point the awakening will be painful and embarrassing.

Perhaps a brief description of the freight business conducted by the Iowa & Illinois Railway Co. may be of interest as illustrating the point brought out in the foregoing paragraph. We went into the freight business in a very tentative manner. In fact, it took considerable time for us to decide whether or not there was sufficient business in less than car-load lots to warrant the purchase of a freight car and the expense of operating a freight business.

The next grave question was that of rates, and, after considering for some time a reduction of the rate below that permitted by the Iowa state laws for class "A" roads, we finally concluded to adopt the maximum tariff and to consider the business as freight and not express.

At first our old passenger depot in Davenport served also as a freight depot, but within a very few months, we outgrew the capacity of the space allowed to freight and were forced to take our passenger business to a new location. In Clinton, we still have sufficient space to handle the business, but within a very few months we will be compelled to seek additional storage room.

Immediately upon starting the business, we engaged a commercial agent, and the quick growth of the receipts to the point where we are paying expenses showed our wisdom in so doing. Within one year, with one freight car engaged in the business and the use of passenger coaches to carry some freight, the business grew to a gross exceeding $10,000 a year. During the summer and fall of 1906, we were compelled to operate our freight car two round trips per day for nearly 75 per cent. of the time, and after the contract with the American Express Company was put into effect, we purchased and placed in service a trailer freight car, having the same capacity as the motor. The improved facilities which we have been able to offer shippers since purchasing the second car have increased the business at a very rapid rate.

We make a specialty, on less than car-load business, of beating the time of the steam railroads twenty-four hours between Davenport and points on the Chicago & Northwestern Railway in the western part of the state. For this reason, we obtain considerable business which is transferred to that road.

Besides this, rush shipments in small quantities of perishable goods, such as milk, cream, butter, eggs, fruit, etc., from certain stations are handled in the baggage rooms of the passenger coaches.

We find that a trailer freight car is much cheaper to operate than a motor, but of course, it can handle only through business. It does not seriously delay the passenger coach to which it is coupled.

When the freight business was started, we adopted what we considered to be a very simple set of forms for billing and accounting, but we soon ascertained that the tracing of damaged and stray shipments was very difficult, and after carefully looking over the field we finally adopted the forms used by the Chicago & Northwestern Railway. These appeared at first to be very complicated, but a short acquaintance indicated their simplicity and the ease of tracing damaged and stray shipments.

We make a specialty of rush orders by telephone via our private line. Often a merchant in Clinton who finds himself short of some particular article telephones to us and through our Davenport office via the private line, we transmit the order to the shipper in Davenport. Shipments so ordered are frequently in Clinton within two hours from the time we were called up at the Clinton office.

Wherever possible, we deliver from the cars to the store doors, which saves drayage and naturally brings business to us. A number of small platforms at which we stop the local express cars have been built by the shippers between towns.

We constantly endeavor to please our shippers and to show a spirit of cooperation, which has a great influence on the growth of the business.

We endeavor to be conservative in charging off expenses against the freight business and work into it anything which rightfully belongs there. We go so far as to charge off monthly three per cent. of the gross receipts. This is piling up a tidy fund, but we propose to allow the account to grow, for at any time we may have to meet heavy freight damages due to fire, water or wreckage.

At the present time, the earnings from this business amount to 15 per cent. of the total gross and we hope to see it reach 20 per cent. on the same basis, i. e., while our freight business comes under the head of class two.

Our transfer business has been developed under heavy steam road competition at lower rates, for in obeying the state laws we have been compelled to charge two local rates which are higher than the rate for the same mileage in a continuous haul on one road. The saving of time mentioned above has accomplished that result.

A recent ruling by the Iowa Railway Commission reduces the tariff on two locals 20 per cent., and although our receipts per shipment will be naturally reduced, the increase in volume of business will be gratifying.

This exposition of the freight business as conducted by the Iowa & Illinois Railway is not made so much to indicate what is being done by that road, but is rather intended to illustrate the methods generally pursued by interurbans of like character.

An investigation made of a number of roads has brought out the fact that the average interurban conducting a freight business pursues practically the same methods described in this paper. There are of course, a number of roads which pursue other methods and successfully too, but in such cases, local conditions govern to a great extent.

The percentage which earnings from freight traffic bear to the total gross earnings of course depends largely on local conditions, but of those roads which have favored me with statistics, I have ascertained that these earnings vary from 5 to approximately 40 per cent. of the total gross. Interurbans which handle car-load business, in addition to the traffic of which this paper treats, in some cases enjoy gross earnings from freight exceeding those derived from passenger traffic.

I believe the experience of interurban railways to this date is that such satisfactory results are now being obtained, I am safe in predicting that any average interurban railway, the existence of which is warranted by prospective passenger traffic, can be assured of a profitable freight business, which within a few years, if not immediately, will become an important factor in its earnings.

President Beggs:—We have another paper on this general subject and, before opening the discussion, I believe it would be well to have both presented, after which they will be before you for discussion. I will therefore call upon Mr. H. H. Polk, of Des Moines, Ia., to present his paper entitled "Freight Service on Electric Railroads."

## FREIGHT SERVICE ON ELECTRIC RAILROADS.

By H. H. Polk, *President and General Manager,*
Inter-Urban Railway Company, Des Moines, Ia.

The first electric railroads built were nothing more or less than street railways extended into the country, the track being laid upon the public highways, constructed of light rails and ties, and in most instances operated by street railway men who had had no experience in steam railroading. They, therefore, did not realize the great possibilities of freight as a source of earnings. Had they, however, given serious thought to the freight question it would have been immediately dismissed owing to the character of constructions and the equipment then in vogue.

These conditions have changed, and the modern electric railroad is following very closely standard steam railroad construction, which means low grades, minimum curvature, heavy rails and bridges, and also the private right-of-way, which permits of high speed and the handling of any kind of traffic. In every territory occupied by an electric railroad there will be found freight to be shipped in and out. The electric railroads will have steam railway competition or they will not. If they have no competition they should get all of the freight to be moved, both car-loads and less than car-loads. If they have competition and make the proper effort, they should get practically all of the local or less than car-load shipments owing to the frequent and rapid service which can be given.

If an electric railroad is fortunate enough to have traffic arrangements with connecting steam railroads it should secure a large portion of the through car-load foreign shipments to competitive points. It seems to me that steam railroads that refuse to recognize electric railroads because they are such, are very short-sighted. They cannot, by this policy stop the building of electric railroads and the electric railroads can be made good feeders for steam railroads, if afforded proper treatment by them, such as publishing joint tariffs and granting a division of the rate, thus securing for the steam railroads much freight which originates on the line of the electric railroad. There are also many instances where the electric railroad taps a new territory, one to which the steam railroad has heretofore never had direct access. In order to do a successful car-load freight business it is absolutely necessary to have a traffic agreement with at least one connecting line of steam railroad, for if this cannot be accomplished, then the rate from a point on the electric railroad to a point on the steam railroad would be the sum of the two locals, and therefore prohibitive in most cases.

The question of interstate through routes and joint rates and facilities for the interchange of traffic is fully covered in the Hepburn Act and the Interstate Commerce Act. It is provided in section 15 of the Hepburn Act, that "The Commission may after a hearing on complaint, establish through routes and joint rates as the maximum to be charged, and prescribe the division of such rates as hereinbefore provided, and the terms and conditions under which such through routes shall be operated, when that may be necessary to give effect to any provision of this act, and the carriers complained of have refused or neglected to voluntarily establish such through routes and joint rates, provided no reasonable or satisfactory through route exists, and this provision shall apply when one of the connecting carriers is a water line." We are awaiting with deep interest the decision of the Interstate Commerce Commission on the complaint made by the Cedar Rapids & Iowa City Railway Company against the Chicago & Northwestern Railroad Company, charging them with refusing to establish such through routes and joint rates.

Mr. A. B. Stickney, President of the Chicago Great Western Railway Company, and one of the ablest railroad men of to-day says that he does not care how freight is brought to his road; whether in a wheelbarrow, stage-coach, horse car, or by an electric car, he will take it and be willing to pay something to get it. This is the broad view to be taken of this question. I think it is generally conceded that the electric railroad is more popular with the farmer than the steam railroad. Accorded the proper treatment, the majority of farmers living along an electric line will take great pride in it, and soon come to think that it is their railroad. It is more profitable for them to ship over the electric line than over the steam line as the former gives them more rapid, frequent, and fully as reliable service, enabling them to receive and ship freight, mail, and express at almost any hour of the day. The farmers, merchants and manufacturers will generally ship their products over the electric railroad if they are given the opportunity, for in a great many ways it is much more convenient than shipping via the steam railroads and hauling long distances in a wagon.

With the electric railroad doing a general railroad business, such as the hauling of passengers, freight, mail and express, running through the farms or near them, it is of course a simple matter to market the produce of the farm, including fruits, poultry and dairy products. This farm produce can be marketed regardless of the condition of the roads at any time of the year. It should be the policy of electric railroads to put in side tracks, stock-yards, loading chutes, etc., whenever it is shown that they will be used. Stock can then be loaded on the farm without driving it seven, eight or ten miles to some railroad station. The estimated shrinkage for driving cattle twelve miles is forty-seven pounds per head, while the shrinkage in transit is but twenty-seven pounds per head, when shipped three to four hundred miles. By using the electric railroad, the shipper will save the resulting shrinkage from driving, and has his choice of the steam railroads of larger cities, enabling him to obtain the lowest rate and the shortest route.

The electric railroad having joint rates with connecting steam railroads gives to the farmer the advantage of such through line. He has merely to notify the electric railroad of his intention to ship over a certain road and he will be supplied with a car from that road. He can also ship in tile, coal, machinery, cattle, hogs, etc., having cars set upon sidings on or near the farm, eliminating the long haul to the railroad station.

Much the same thing is true of the smaller cities and towns through which the electric railroad runs. A merchant can easily order by telephone from the wholesale houses, and within an hour or two the goods so ordered are in his store. Is it not true then that these advantages will give to the electric railroad all of the business it can handle?

Steam railroads are the main arteries of commerce of the world; electric railroads are the capillaries that bring life and activity to the various communities. This being true, the prosperity of the community depends largely upon these smaller avenues of trade, and the electric railroad built through unoccupied territory (I mean a territory lacking in steam railway advantages) with the proper facilities offered in the way of freight depots, loading platforms, stock-yards, elevators, and reasonably good service, can obtain a great deal of freight both car-loads and less than car loads.

The bulk of the business of steam railroads is made up of car-load freight. Mr. Lyman E. Cooley, the noted engineer of Chicago, is authority for the statement that over two-thirds of the freight moved in the United States consists of fuel, ore and building materials. All of these are handled by rail in car-load lots. Now add to this the total of other commodities and livestock known to move regularly in car-loads and it seems to be a reasonable assumption that the amount of car-load freight in the United States is not less than 85 per cent. of the total freight handled. Without access to the records of the steam railroads it is of course impossible to say just what proportion the car-load traffic bears to the whole freight traffic handled.

In a recent hearing in Minnesota this subject of car-load freight was dealt with very exhaustively, and the railroads asserted and attempted to prove that the less than car-load freight was very expensive, and did not yield its fair share of the net, total revenue, on account of the cost of handling. This seems to be the prevailing opinion among steam railroad traffic men. They solicit the car-load freight more strenuously than they do the less than car-load, and will gladly take it at much lower rates per hundred pounds, than the less than car-load or package freight.

Some of the reasons given in support of this opinion are:

1st. That car-load freight is loaded by the shipper and unloaded by the consignee, thereby relieving the railroad company of the responsibility of loading and unloading, and the cost of handling.

2d. That a very large percentage of it is handled on private terminals.

3rd. That for the two reasons given above, the risk from loss and damage is very much less.

4th. That less bookkeeping and accounting is necessary on car-loads.

5th. That is costs much less per ton to move ordinary commodities, such as move in car-loads, than to move a car of merchandise or package freight.

Accurate data on the cost of handling freight on electric lines is very difficult to obtain. I addressed letters to the general managers of thirty electric railroads, asking for certain information relative to the cost of handling freight. I received replies from the majority stating that they did not keep their records of handling freight and passengers separate and therefore could not give the desired information. I am therefore compelled to resort to our own experience.

Some comparison of statistics of freight traffic on steam and electric railroads may be interesting here.

During the year 1904 steam railroads of the United States handled 1,306,628,858 tons of freight, at an average revenue of four-fifths of one cent per ton-mile.

The Baltimore & Ohio earned five and eighty-two hundredths mills (0.582 cents) per ton-mile. The Inter-Urban Railway earned 5.928 cents per ton-mile. The great difference in the cost of handling and the amount earned is caused by the difference in the average distances hauled. The Baltimore & Ohio's average haul was 192.84 miles, while the Inter-Urban Railway's average haul was only 10.5 miles.

In the following table I have taken the earnings of steam railroads from all sources, with the per cent. that each item is of the total as published in the annual statistical report of the Interstate Commerce Commission for the year ending June 30, 1901, and the earnings of strictly electric railroads from all sources with the per cent. that each item is of the total, as published in the latest reports of street and electric railways, compiled by the Department of Commerce and Labor, Bureau of the Census, for the year ending June 30, 1902.

| 1901. | Steam. | % | | Electric. | % |
|---|---|---|---|---|---|
| Passenger....... | 351,356,265 | 22.12 | | 233,821,549 | 94.4 |
| Mail............ | 38,453,602 | 2.42 | | 432,080 | 0.2 |
| Express......... | 31,121,613 | 1.96 | | 401,672 | 0.2 |
| Other Car Pass... | 8,202,982 | .52 | | 303,608 | 0.1 |
| Freight......... | 1,122,608,471 | 70.67 | | 1,038,097 | 0.4 |
| Other earnings... | 36,729,104 | 2.31 | Sale of Electric Current. | 7,703,574 | 3.1 |
| Miscellaneous.... | 54,000 | .01<br>Less | | 3,853,420 | 1.6 |

On steam railroads it will be noted the receipts from freight traffic is about 70 per cent. of the gross earnings, while on the electric railroads the average receipts from freight is only 0.4. However there are a few electric railroads that receive for freight between 20 and 35 per cent. From the above it is evident that freight traffic on electric railroads has not yet received the attention which we believe its future development will justify.

Mr. E. E. Kimball of the Railway Engineering Department of the General Electric Company has very kindly given me some data on power consumption and cost of maintenance of electric locomotives and passenger cars.

## ENERGY CONSUMPTION.

### *Freight Trains.*

| GROSS WEIGHT IN TONS. | Schedule speed between trains. | Watt-hours per ton-mile at locomotive. |
|---|---|---|
| 100.......................................... | 15 m.p.h. | 28 |
| 200.......................................... | 15 m.p.h. | 23 |
| 300.......................................... | 15 m.p.h. | 20 |
| 400.......................................... | 15 m.p.h. | 19 |
| 500.......................................... | 15 m.p.h. | 19 |

*Interurban Cars.*

| GROSS WEIGHT IN TONS. | Maximum speed. | Stops per mile. | Watt-hrs per ton-mile. |
|---|---|---|---|
| 20 | 45 m.p h. | 0.50 | 80 |
| | | 0.75 | 87 |
| | | 1.00 | 92 |
| 40 | 45 m.p.h. | 0.50 | 07 |
| | | 0.75 | 76 |
| | | 1.00 | 81 |
| 50 | 45 m.p.h. | 0.50 | 67 |
| | | 0.75 | 73 |
| | | 1.00 | 78 |

The cost of repairs and maintenance of a 40-ton locomotive equipped with 100 h.p. d.c. motors when hauling a 200-ton train about 100 miles per day will average about 1.5 cents per locomotive mile. This includes repairs to motors and control, and care of locomotive.

The cost of repairs and maintenance of interurban cars will average about 1.5 cents per car-mile. This figure includes cost of repairs to motors and control, and cost of cleaning the car bodies.

Of course these figures will vary considerably on different roads in different sections of the country, owing to the service conditions of the road. It will be noted from the above data, that as the weight of the train increases, the power consumption decreases per ton-mile, this of course is due to wind pressure per ton. This is also true of power consumption on passenger cars, but the passenger cars will use more power per ton-mile on account of making more frequent stops.

The report of the Inter-Urban Railway Company for the year ending June 30, 1907, gives the following statistics on freight:

|  | Number of tons carried. | Per cent. of tons carried. | Average rate received per ton. | Freight revenue. | Car-loads handled exclusive of switching. | Car-loads switched. | Number of tons carried one mile. | Number of tons carried one mile per mile of road. | Average receipts per ton-mile, cents. | Operating expense per ton-mile, cents. | Operating expense per cent. of freight earnings. | Freight earnings per cent. of gross earnings. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Local freight car-loads. | 65,052 | 78.94 | $0.406 | $26,421 11 | ...... | ...... | 694,828 | 9,677 | 3.802 | ...... | ...... | ...... |
| Local freight less car-loads............. | 8,116 | 9.85 | $2.27 | $18,423 32 | ...... | ...... | 85,920 | 1,197 | 21.443 | ...... | ...... | ...... |
| Foreign freight car-l'ds | 9,195 | 11.16 | $0.84 | $7,723 80 | ...... | ...... | 107,335 | 1,494 | 7.724 | ...... | ...... | ...... |
| Foreign freight less car-loads............. | 40 | 0.05 | $2.67 | $106 80 | ...... | ...... | 443 | 7 | 24.131 | ...... | ...... | ...... |
| Total............... | 82,403 | 100.00 | ...... | $52,675 03 | 3,627 | 1,484 | 888,526 | 12,375 | ...... | ...... | 0.37 | 0.23 |
| Average............. | ...... | ...... | $0.6392 | .......... | ...... | ...... | ......... | ...... | 5.928 | 2.194 | ...... | ...... |

An electric railroad, in order to do a general railroad business must be equipped to properly and promptly handle any business given to it.

1st. The freight department should be in charge of a general freight agent, who should be held responsible for all matters pertaining to his department. He should also pay strict attention to freight claims, giving them a thorough investigation and adjusting them promptly. There is no excuse for delay in settling claims promptly, as the mileage of the majority of electric railroads is short, and the stations few as compared with steam railroads, it is therefore much easier to locate damages, shortages and delays.

2d. In the large cities a good solicitor should constantly be at work, keeping in touch with the freight situation, making regular calls upon the merchants, manufacturers, dairy concerns, wholesale houses, etc., as well as soliciting business from the farms through which the road runs and from as far away as it is possible to draw it. The amount of business obtained by a solicitor five or six miles away, on either side of the road is astonishing.

Besides soliciting, he should find a market for the products of the farm, such as dairy products, poultry, fruit, vegetables, etc. Encourage all of these lines and the freight business will rapidly grow.

3rd. The accounting is a matter of so much detail that it will be impossible for me to cover it in the limited space allotted to me. I will say however that transportation of freight on electric railroads is so nearly identical with that of steam railroads that it is very essential that the general form of steam railroad accounting be adopted.

4th. There should be a commodious freight house, centrally located, and convenient to wholesale houses. This is of primary importance in the larger terminal cities. The freight house should be built on the most approved design in order to economically handle freight. There should be doors on one side convenient for the use of teams. Opposite these doors should be located the doors for loading and unloading of cars, so that the truckers may truck from the wagons directly to the cars or vice versa.

This house should be in charge of the agent, and under him should be a foreman, and as many men as are needed to properly handle the business. There should also be in the larger terminal cities and smaller cities, freight-yards, with sufficient switch tracks and team tracks.

5th. Each of the stations along the line should have a freight-room, in charge, of course, of the station agent. The duties of the agent are of course many outside of the freight service. He receives and issues train orders, sells tickets, and solicits passenger as well as freight business.

6th. At all stations or side tracks, shippers should be encouraged by the company. In addition to the stock-yards, and loading chutes for the convenience of stock shippers, it is also of great importance to have depot grounds of sufficient size to permit the leasing of a part of them for a nominal rental to persons desiring to put in grain elevators and other industries that will ship their products.

In my opinion, grain is one of the best paying commodities to handle, and effort should be made to obtain shipment of this commodity.

7th. The rolling stock should be modern, the electric locomotives equipped with motors of sufficient capacity to handle trains of at least one to fifteen cars at a speed of at least twenty miles an hour or better, in order not to interfere with passenger service. The company should own enough box and flat cars to properly handle the business.

The service must be of the best; its frequency depending upon demand and incidentally upon competition.

8th. The small or less than car-load shipments should be handled in express cars, equipped with motors of at least the same capacity as the passenger cars.

The less than car-load shipments on the Colfax division of the Inter-Urban Railway are handled in express cars, at freight rates. Car-load shipments on this division are handled by an electric locomotive when necessary. While on the Beaver Valley division we have a way freight leaving Des Moines at 4:00 o'clock in the morning. This train is composed of an electric locomotive, merchandise cars, car-loads, and a caboose. It picks up all car-loads and does all the switching at the various stations, out and back, setting loads and empties at the various elevators, stock-yards, coal mines, etc.

## RATES.

Until 1887 nearly every large railroad had a classification of its own, but now most business is handled by one of three classifications. These are the Official, which is used in the east, the Southern and the Western. In several states, Illinois, Iowa, Georgia, and some others, there are classifications prescribed by the State Board of Railroad Commissioners applying to freight carried entirely within the state. The electric railroads should use the classifications and rates which are used by the steam roads in their territory.

It may be interesting to know how the freight rates of the United States compare with those of some of the European countries. In England the average amount paid by the shippers for moving a ton of freight one hundred miles is $2.35, in France $2.10, in Austria, $1.90, in Germany, where most of the railroads are owned and operated by the Government, $1.84 in Russia, $1.70; while in the United States the average cost to the shipper is only 73 cents or less than 40 per cent of average cost in Europe.

A report of the Department of Commerce and Labor for the year 1902, in a general discussion of the characteristics and significance of electric railroad service, says: "It is difficult to avoid entrance into the domain of prophecy. Some of the electric railroads have already made such progress in methods that certain prophets look forward to the complete superseding of steam traction by electric traction. However this may be, it is evident that, even if the electric railroads confine themselves to the methods already widely prevalent, they are bound to become a social and economic factor of enormous importance. Remarkable benefits have already been realized from the existing electric lines, and the extension of such railroads to a large proportion of our more prosperous communities seems but a matter of a short time."

President Beggs:—The two papers by Mr. Crafts and Mr. Polk are now before the association for discussion, and I would ask the indulgence of the association for a few minutes. I have an engagement to appear before the Manufacturers' Association in its annual session, and I will therefore ask Vice-President Brady to take the chair until I return.

(Vice-President Brady in the chair.)

Vice-President Brady:—The papers which have been read are now open for discussion, and we shall be glad to hear from any of those present.

### *Discussion of Papers by Mr. Crafts and Mr. Polk.*

Mr. Crafts:—I wish to add, gentlemen, that the reduction of 20 per cent. in tariff, which we are compelled to make by the Railroad Commission of the State of Iowa, has resulted in a very appreciable increase in the amount of freight carried. This increase has greatly overcome the reduction in rate. The question that naturally would come to your minds—because we handle not only local traffic, but traffic which we transfer to a steam railway—is whether or not the local traffic could be operated on a paying basis. I have therefore compiled a few figures this morning showing the proportion of transfer to strictly local traffic. I find that of our total receipts from freight 71 per cent. is from local traffic and 29 per cent. from transfer, which practically follows out the proportionate tonnage carried.

Mr. Hippee:— Your reduction of 20 per cent. is only on joint carry?

Mr. Crafts:—Only on two locals. That does not apply to a continuous shipment. I have here a few forms which I will be glad to explain to anybody interested, and which I will now endeavor to show you as well as possible, giving you an idea how our business is handled. These forms are not enlarged. This first form is a receipt and bill of lading and is a strictly steam railway form complying with the laws of the state. Our way bills are of a standard form as well. The expense bills are of a form differing considerably from the general run of forms which you find amongst the steam railways. This is one, however, which has been adopted by the Chicago & Northwestern Railway, and as I stated in my paper, although they look complicated, a short acquaintance makes them very easy to handle.

The great advantage of these forms lies in the fact that we can trace a shipment that is damaged or strayed with perfect ease. The rest are, with few exceptions, merely duplicates and book forms. We are using the same standard form of abstract as is used by the steam railways. In explanation of our cash book form, I might state that we handle our freight business just the same as we would handle an entirely independent line of business. The freight business is credited with the receipts and charged with all payments made by the agents, or those authorized to make payments. We therefore obtain a net return, except for such expenses as we charge off in the operating books.

We also have adopted, at the suggestion of the Chicago & Northwestern, a delivery ticket which is a very valuable feature. We do not allow a single thing to go out of our freight house without the driver or party taking the same signing the delivery ticket, whether or not the expense bill is there; this certainly cuts down a large number of claims. I would be very glad to answer any questions and to give you any information regarding our freight business that I can consistently let you have.

Mr. Allen:— I have listened with a good deal of interest to the papers which have been read. I must say that my observations, and the standpoint from which I have viewed this matter, have been contrary to the views presented in the papers. My limited experience in the handling of express or freight has been confined to what is known as package or light freight. In fact, we do not apply that term in our business but we call it electric express. I think in New York

State, of the roads that are transacting an electric express or freight business, the majority are transacting that business at the expense of the regular passenger business. I will go a point further. I believe that for every dollar they are putting in they are only taking out 90 cents. That is a pretty broad statement to make, but I believe when the accounts are analyzed and the proper charges have been made to the cost of conducting this department, that these results have been produced in the past.

At a meeting of the New York State Street Railway Association held last month at Kingston, a committee was appointed to collect from the roads in New York State complete data as to the class of goods or materials, in other words, consignments, which are transported, and the cost of conducting the transportation; and we hope to have before another year passes some results which will be tabulated and which will be valuable information to those of us located in that territory. I know of but two roads in Central New York that are handling freight business in carload lots, and one of these properties I am familiar with and I know for every dollar which comes in as receipts on this class of business they are spending one dollar and a half to get the business.

My viewpoint, as I have stated, is opposite to that which is presented in these papers. It may be that local conditions in our section control. I have been greatly interested by the data presented and by the results which the gentlemen have produced.

VICE-PRESIDENT BRADY:— Mr. Emmons, of Fort Wayne, Indiana, has had considerable experience, I understand, in connection with this subject, and we will be glad to hear from him.

MR. EMMONS:— Our experience in the freight handling business has not been quite as disastrous as that described by the gentleman who has just spoken. We must all realize that in starting out in a business of this kind it is a business which must be developed and which must grow. We have been in the business for the past two years, and have had to increase our facilities largely. We started in with earnings of from $5 to $10 a day for running a car a short time, until at the present time the receipts of our freight cars in service are averaging between $75 and $100 a day for 10 to 15 hours' service. Our last expense account, in which we have had itemized the investment, shows not as low as the paper states here (37 per cent.), but about 60 per cent. of the gross receipts from the business.

We have recently been forced, on account of business presented to us, to attach a trailer car, and we feel that by the development of the trailer business we will reduce the percentage of operating expenses. In our territory we feel that freight handling is a large factor in the development of our properties, especially along the lines presented in these papers. The farmers along our line are beginning to ask for sidings, to get coal in, to ship cattle, and in that way we anticipate a large development in our business.

VICE-PRESIDENT BRADY:— It is apparent from the papers here presented and the discussion which has followed, that this matter depends to a certain extent upon local conditions, and the more widespread the location of the individuals who speak, I think the better informed we will be.

MR. PECK:— The Schenectady Railway Company is operating a freight and express business under a separate corporation, and we have thought, contrary to Mr. Allen's experience, that we were making money. All items of expense in connection with our freight business are charged independently, and not mixed at all with our passenger expense, and in our operations of the express and freight business last year, we showed 20 per cent. profit on our business, and we certainly intend to continue in that line, as we have been very successful.

MR. PARDEE:— From the experience that I have had in the operation of express and freight service, I have come to the conclusion that it is a matter dependent on the locality. If the electric railway operating the freight service is in competition with good service on a steam road, it is at a great disadvantage in competing for heavy, bulky and carload freight. There are exceptional conditions under which that kind of freight can be hauled at a very handsome profit, but those are individual cases and cannot be covered by any general rule. The steam railroad hauls freight in comparatively inexpensive cars in which it has not a large investment, and the electric railroad attempts to compete with the steam railroad and hauls the freight in a car costing at least seven or eight times as much; so that if you look at the interest on the investment and the depreciation of these cars in which this heavy freight is hauled, you will have to correct some of the operating reports to include the interest and depreciation.

I do believe there is a profit in the express business and that this profit depends very largely upon the classification. I also believe that the classifications of the steam roads and of the old line express companies should not be followed, but that each road or each class of road operating under similar conditions must work out its own salvation in its classification. If that is properly worked out, then there is money in it.

The reason that a great majority of the shippers ship by electric express instead of steam express is that the electric railway company delivers the goods quicker and better and that the service is more satisfactory, and that a very large percentage of the shippers are willing to pay more money, and an electric railway with an express business and quick delivery can get the business at a higher price. I have changed my mind on that point, from the views which I held a year ago. I thought at that time it was necessary to go below the steam railroad rate. I do not now think it is necessary to do so, and the business can now be obtained at a rate on which there will be a profit, but a very large part of the freight business on electric railways, except in special cases, at the present time is not showing any real profit.

Mr. Allen:— When you called on me first, Mr. Chairman, I was taken somewhat at a disadvantage and I want to put myself right. The papers under discussion, as I understand it, refer to the carrying of freight. I do not think there is any doubt in the mind of any one who has had experience with the electric express proposition — and by that I mean to pick up and deliver express packages, including transportation,—can be made successful, but when you come to the question of handling freight, as the gentleman who has just spoken so ably points out, taking a car costing $1,000, hauled in trains of fifty or more cars, and then consider the transportation of the same freight at the same rate per ton mile, in a car costing $10,000, including two or three men to a car, it certainly must be apparent that we cannot produce the same net results.

I am a great believer in electric express. We have for five years tried to see what results can be produced in operating what is known as electric express, but the results produced from hauling freight, on most of the roads which have undertaken this service, have not been what these roads were led to expect.

Mr. Parker:—The Detroit United Railway has been in the electric express and freight business since my connection with the company, which began September, 1901. At first we adopted tariffs along the steam road lines, but as our experience in the handling of express and freight broadened, we have tried to make and are still making changes in our tariffs. We have now reached the point where we are confining our efforts as much as possible to the high class traffic, declining wherever possible by restrictions, etc., the class of freight which is either inconvenient or too expensive to handle on electric express cars. For example, the rate on household goods in small lots, formerly took first class rates. We have raised this to double first class rates, and as fast as our tariffs are reissued will place this class of freight on three times first class rate basis, and so on down the line with the undesirable shipments. In a good many cases we have an established minimum charge per shipment, which action has kept us away from a lot of undesirable freight.

As to using the steam road rates as a basis for the handling of freight business for all conditions, I am not now a strong believer in that policy. As an illustration, on one of our lines the mileage from Detroit to the terminal point is 57 miles, and this territory is served by three steam roads. In this instance we are protecting steam road rates, with certain exceptions. We are to-day operating three cars per day, excepting Sunday, on which day only one express car is run. In addition to paying tribute to the city of Detroit of $1 per car per round trip, we join in the expense of freight terminals, separate baggage rooms, and separate ticket offices, including tribute on a mileage basis to the line over which we have running rights to the freight terminals. Consequently when you have added to this the expense of operations of cars, interest and depreciation, there is not much left for net earnings. I am therefore not a strong believer in the steam road rates as an electric freight basis. Do we get any business, the qquestion may be asked? Yes, more than we can take care of, and this right in the face of a strong water competition during the summer time.

On short hauls, I am in favor of steam road rates on package freight business, if rates are high enough. When it comes to long hauls, I try to strike a conservative policy if it is possible to do it. Under no circumstances do I go below the steam road rates, but try and go above them, because just as soon as you lower your rates, you get a volume of business the greater part of which is undesirable and inconvenient to handle, and which you cannot take care of without great expense.

What Mr. Crafts has said in his paper has impressed me, particularly where he says, "At the present time the earnings from this business amounts to 15 per cent. of the total gross, and we hope to see it reach 20 per cent. on the same basis, i. e., while our freight business comes under the head of Class 2." I would like to know if the earnings mentioned are net?

MR. CRAFTS:— They are gross, Mr. Parker. Our net on that is approximately 40 per cent.

MR. PARKER:— Speaking of the second paper, which was read by Mr. Polk, it has been very interesting indeed, and I consider I have received a great deal of valuable information from it. Taking the paper as a whole, I doubt very much whether the handling of a carload business such as grain, etc., in a electric motor car, is a good thing, especially at steam road rates. If arrangements can be made to handle carload business of this nature in steam road equipment furnished by the steam road at your junction point, whereby you practically do only the necessary hauling in the way of movement either way, at a fixed switching charge per car, or a fixed arbitrary rate per net ton, with a minimum charge per car, I believe it could be worked out satisfactorily from a revenue standpoint, but when it comes to furnishing high class equipment for low class traffic, I am not in favor of it.

Mr. Polk:—My paper was on carload freight and that freight is handled in box cars without any motor equipment whatever and pulled by an electric locomotive. Now, I claim, when you can make $15 to $25 and $35 a car and haul eight or ten cars in the train, you are making money; our freight department is kept entirely separate from the passenger department, and our line is laid entirely on private right of way. We are not bothered in any way by any franchise restrictions, and we are permitted to handle it with any kind of equipment. Regarding rates, we started out to use 85 per cent. of the Iowa distance tariff and we have recently put in the same rate that is charged by the steam railroads and are getting more business than we had before.

Mr. Hippee:—I think the remark that was made by one of the gentlemen here to the effect that this is purely a local condition is to some extent true; but it is true to a greater extent that almost every man that is to-day interested in interurban roads was once a passenger man. When freight business was first suggested, I thought there was nothing to it, but as it developed it showed that there was money in it, especially for heavy freight. As Mr. Polk has said, there is no investment in rolling stock to haul that freight, the cars are furnished us by steam railroads. They are loaded and delivered to the steam railroads. We can go into competition with steam railroad lines that we have no general rates with, but give our business to the lines with which we have rates. In that way we make a larger earning in proportion to what we haul. Of course, the longer trains we haul the less the expense and the greater the earnings. That would keep our operating expenses down, which will be higher for package freight or express business. Our express business is handled on the Iowa distance tariff. When it comes to the question of the money you have invested in expensive equipment, you haven't got it invested if you are doing a heavy freight business, and that is what the interurban railroads of the West are certainly coming to. If the steam railroads can develop their freight business, why can't we? I would rather have the freight business two to one than the passenger business, if from no other reason than the question of hazard.

Mr. Dimmock:— The question of freight has interested me greatly from the fact that I believe the figures named will hardly come up to the amount of freight that we are handling. We have in service between 300 and 400 freight cars. We are operating some 12 to 14 freight trains per day. Some of these trains haul as high as 700 and 800 tons per train, at a speed of from 15 to 18 miles per hour. Other lines are operated in single units, or with cars that are equipped with motors and are not run as a train. The amount of business that we are handling has increased so fast that we wish we had about 200 more cars to take care of it. It has grown so heavy that the State Commissioners now consider that we are on a par with steam railroads as to the business carried and importance of it, and have placed us under their wing, and so has the Interstate Commerce Commission. The different classes of freight which we handle might be interesting to you from the fact that we are carrying between Seattle and Tacoma some 2,000 to 3,000 gallons of milk which is picked up through the valley and taken into Seattle each morning on a special train. We have two or three trains per day of 10 or 12 cars of coal — 60,000 lb. capacity cars — pulled with a locomotive or an ordinary box car type car G-66 motors, four of them, of 124 h. p. each. We also have a refrigerator line. We are fortunate in having packing houses located in Seattle and in Tacoma, and each one of them desires to ship its product to the other city, so we get the freight both going and coming. The cars operated in those trains are built on purpose for the hauling of beef, which is hung in the cars by halves — in other words, the beef is not quartered after it is killed. The cars are some 14 feet high, operating around 8 per cent. curves, and at high speed. We have been doing this for the past five years, and have had no accidents. The beef is killed in the afternoon at three o'clock and at half past five it is hung in these refrigerator cars, and at six o'clock pulls out of Tacoma or Seattle as the case may be for the opposite city, and is gotten in there in the course of a couple of hours and unloaded, and while it is being unloaded the same motor is at the local freight stations picking up other freight, and the cars are hauled back and ready for service the next day. This is an interurban line that I am referring to, between Seattle and Tacoma. In addition to this, we operate two local freight trains out of each city every day, and they have all the business both in carload lots and local freight that they can possible handle. We find that the expense of this freight will, I think, without definite figures, run about 45 or 48 per cent., probably 50 to 52 per cent., including the depreciation of the cars. I have heard some remark in regard to the cars costing so much money. We find we can get very desirable flat cars for anywhere from $450 to $550 delivered on the coast. Now, we have also some twelve miles of sidings on our suburban lines, where we are hauling timber in trains of five and six cars, in many places over 5 and 6 per cent. grades, which bring us in a very handsome revenue. I may say we are handling on an average of $225,000 of freight business gross per annum. Of these twelve miles of sidings which I referred to the sidings are run into the private property of people owning timber and woodlands, wherever it is convenient to get them. The siding is generally built at the expense of the man owning the ground or the timber, we being put to no expense other than leasing to him the rails which we keep on hand for that purpose, and which have been taken out of stock from points where we have rehabilitated the lines. In addition to the wood business we find the local freight — what you would call small package freight — is increasing very materially and upon one line which was about seven miles long, where we had never done any business at all, our traffic manager insisted that he thought a business could be built up in that locality. We started and the first two or three months I might say the business was practically nothing. At the end of one year we now have one freight car running on that line constantly, and are thinking of putting on the second, the local package freight being so heavy that it is impossible for us to take care of it, and this upon a line where it was impossible to see any business at all when we started. These are some conditions in the Far West pertaining to the freight business. We also load heavy standard steam cars with lumber, shipping it into the Middle West over such lines as the Northern Pacific and the Great Northern, and they furnishing the cars, we furnishing nothing at all. A number of mills are located upon our lines, and are so situated that the steam roads cannot get at them. The shipper will demand of the steam road that it furnish cars to us and the cars will be turned over to us at the transfer point, hauled out empty to the place of loading and loaded up and shipped to the Far East or the Middle West. I will be glad to answer any questions pertaining to anything in the freight business, as I believe we are doing about as heavy a business as any one that I have heard of, and I would be pleased to learn of any road that is in this category.

Mr. Crafts:— I would like to ask Mr. Dimmock two questions. You have steam railroad competition, haven't you?

Mr. Dimmock:— Yes, sir; we have two lines paralleling our line between Seattle and Tacoma, and a heavy competition on the boats.

Mr. Crafts:— Does the operation of your freight trains interfere in any manner with your passenger traffic?

Mr. Dimmock:— No, sir; we don't permit that to happen in any way, shape or form.

Mr. Crafts:— You have a modern dispatch system?

Mr. Dimmock:— We dispatch our trains under the standard rules of steam roads, telegraph operators and station agents.

Mr. Hegarty:— What are your operating expenses per ton-mile and your earnings per ton-mile?

Mr. Dimmock:— We have those statistics, but I would hardly be in a position from memory to give you any idea regarding it. We know that the total operating expense of handling this freight, which does not in any way interfere with our passenger traffic, will run somewhere between 45 and 50 per cent. Speaking of passenger traffic being interfered with, I will say that we have trains operating between Seattle and Tacoma every hour, both ways, and at the speed of 65 miles per hour, where out of 36 miles we have 16 or 18 miles of double track. But the most of this freight business is done at night. While we have local freight trains in the daytime, the traffic being lighter at night, we put on those heavy freight trains.

Mr. Hegarty:—You stated that you came under the Interstate Commerce Commission, and I wondered on what basis they figured you.

Mr. Dimmock:—We have only recently come under that head, so we haven't taken that up.

Mr. Hegarty:—Is it figured on a per ton-mile basis?

Mr. Dimmock:—Yes. We are simply brought under the commissioners from the fact that the shippers desire us to exchange cars with the trunk lines.

Mr. McCulloch:—We have no long suburban lines, and unfortunately the gage of our lines differs from the standard gage, so that we cannot handle standard steam railroad cars. We do a small express business on the suburban lines, but are prohibited by city ordinance from handling freight in the heart of the city. We run a refrigerator car for one of the dressed beef companies and haul stone and building material to some of the smaller towns outside of the city; but the volume of business is small, and the revenue does not amount to much. We tried to get some business from truck farmers and people of that sort, but as the distances are very short, they seem to prefer to haul on their own wagons.

Mr. Dimmock:—I might add for the benefit of those who are in a quandary as to the expense of handling this freight, that we pay the motorman 33⅓ cents an hour, the conductors 30 cents, and the brakeman from 22 to 23 cents per hour; therefore you can see we are operating under a high expense, and one which would have a tendency to increase the percentage of operation. Nevertheless, we seem to be getting out on the right side even with the high expense under which we operate.

Mr. Crafts:—I would like to submit a few more details in connection with the light freight handled as to operating expenses, rates, etc. We are doing what, in comparison with Mr. Dimmock and Mr. Polk, is a very small business. It is not strictly package freight. We started in to call it express but later changed our minds, and have since termed it freight. As to the rate, we adopted the standard classification and distance tariff as permitted by the Iowa Railway Commission.

Compiling some figures from certain representative periods during the last year, we have averaged in almost all weeks approximately 550 individual shipments, of which 60 per cent., or 333, were local shipments. The commission allows us to charge a 25 cent minimum. Of the local shipments 50 per cent. are minimum shipments for which we get 25 cents each. These may be packages of 10 ounces, or packages of 300 or 400 pounds. We put that freight in a $10,000, 38-ton car and fill it day in and day out. I believe this shows a profitable return on that class of car.

As to our expenses: without giving dollars and cents, we charge to freight expense a solicitor of whose time a portion is devoted to developing passenger traffic, but that is a small portion; and we also maintain an extra clerk at each end of the line. We also charge such rent, light, and telephones required aside from the passenger business; all books, stationery, etc. We also charge off 3 per cent. of the gross freight earnings for damages, claims etc. The freight cars are charged the same power cost per car-mile charged to passenger coaches, and the same proportion of expenses of maintenance of roadway and cars. Our motormen and conductors are paid 22 cents per hour for all platform time. Even charging to expenses the above items we are able to operate for less than 60 per cent., and as our business grows the proportionate operating expenses are materially reduced.

We find that freight business helps to develop passenger business, and also the minimum package business in the following manner. A storekeeper in a small town, if he is alive, abandons the sale of fancy articles and keeps nothing but staple articles. The farmer drives in puts his horse in a livery stable, and he and his family get on a car and go to Davenport, buy their fancy articles, and come back to the small town. We get the fare but not the freight. But when they are ready to return home from the small town, they go to the grocery, or some other store there, and buy their staple articles. We get the hauling of that staple merchandise in small shipments. The storekeeper is enabled to carry a very much smaller stock of goods because he is certain that he can obtain a supply within two or three hours from the time he notifies our agent to send in an order; his carrying cost is reduced and our receipts per ton are increased.

As to the result of competition with steam railways, although those which we parallel, of which two companies operate over one track, and also operate on the opposite side of the Mississippi, making three roads in all, they do very little less than car load freight business between the terminals. We also had boat competition for two years which absolutely was the meanest I ever saw. The boat cut our rate to almost nothing, yet we maintained our rate and the boat is out of business to-day.

The American Express Company came to us and wanted to handle all of our local express business, which we didn't feel we could permit it to do. It had a very satisfactory through business, but we are better off by handling the local business entirely.

MR. HEGARTY:—All the electric roads which are carrying freight in bulk, are gradually coming under the Interstate Commerce Commission in the different states and the commission requires figures on freight earnings and operation on the per ton-mile basis and I do not think there is any form of accounting, which this association has that covers it. I move we appoint a committee to take up this matter of getting up a classification of accounts on freight earnings and operation, which will meet the requirements of the Interstate Commerce Commission and report at the next meeting.

VICE-PRESIDENT BRADY:—Would that matter come under the head of accounting?

MR. HEGARTY:—I do not think that it has ever been brought up before at this association as it is only recently that the Interstate Commerce Commission has extended its jurisdiction over electric railways which are carrying freight in bulk.

VICE-PRESIDENT BRADY:—I would suggest that it be referred to the Accountants' Association, to take the matter up. Mr. Hegarty's motion is that the Accountants' Association be requested to take up this matter of accounting in freight matters in connection with its general question of accounting on interstate matters.

This motion was duly seconded and carried.

VICE-PRESIDENT BRADY:—The next paper is a paper entitled "A Department of Publicity," by Mr. J Harvey White, of Boston. In the absence of Mr. White, Mr. Blake has kindly consented to read this paper.

## A DEPARTMENT OF PUBLICITY.

By J. HARVEY WHITE, *Publicity Manager,*
Boston Elevated Railway Co., Boston, Mass.

The organization of publicity departments by public service corporations is a comparatively recent innovation. For many years certain corporations have maintained carefully organized and systematically conducted advertising departments, but it has been only within the past few years that a few of the larger companies have established departments for supplying the public with general information relative to their affairs, plans, policies and acts.

Publicity has been heralded as a positive and permanent cure for all corporate ills. A loud and increasingly clamorous cry for corporation publicity is being raised by the public, press and political leaders who commonly represent corporations as monsters of iniquity; plundering the poor defenseless public. So persistently have they been portrayed as institutions of dishonor, greed and oppression, that the public is disposed to believe any accusation against a corporation unless overwhelming evidence to the contrary is produced.

The problems involved in the public relations of large corporations to-day are quite as important as, and in many cases much more complicated than, those embraced in operation. It is in the general field of public relations that a department of publicity finds its principal usefulness and performs its most valuable service. Its function is to enable the public to know the corporation as it really is.

Annual reports disclose the vital statistics relating to operation and finance. These compilations are not only seldom read, but are almost meaningless to the general public. They do not and cannot meet the popular demand for publicity. The public wishes to know and is being educated to the belief that it has an absolute right to know practically everything that relates to public service corporations. A refusal to answer in full every question that may be proposed to a corporation is commonly regarded as *prima facie* evidence that it is afraid to have the truth known and conclusive evidence that it is arrogant, insolent and despotic.

Public opinion is a practically irresistible power. The company that stands discredited in public opinion is hampered and harassed at every turn. It does not receive fair treatment. Its merits are not recognized and every shortcoming is magnified. On the other hand, if the public believes that a company is trying to give an efficient service and a "square deal," its excellencies will receive some recognition and its unavoidable defects will be tolerated with reasonable good nature by a large portion of the community.

No one who participates in the larger responsibilities of street railway management needs evidence outside of his experience as to the power of public opinion or as to the importance of securing and holding the public good-will. It is undoubtedly a fact that the service rendered by most street railways merits a larger measure of public confidence and esteem than is accorded. The reason that the public so often fails to give full credit where credit is due is not because the public is constitutionally unfair, but because it is uninformed or misinformed. To overcome this defect, to eliminate unfairness and hostility based on ignorance or misinformation, is the function of a department of publicity, and the extent to which this is accomplished is a fair measure of the department's efficiency. Responsibility for criticism and opposition based upon real facts must be borne by the general management, but responsibility for hostility and unfairness based upon public ignorance must be borne by the department of publicity if it is authorized to make the real facts known.

The most efficient, available and practical agency for developing a fair and even friendly public sentiment is the local press. If the local newspapers constantly condemn the service and policy of a corporation, even though the criticism be unfair and unfounded, the public is certain to become antagonistic. If, on the other hand, the facts presented by the newspapers to their readers show that the company is alive to its obligations and is giving a reasonably good service and that its shortcomings are not due to indifference, inefficiency or willful disregard of public rights, public unfriendliness will be reduced to a minimum.

The first step toward securing fair treatment of a company by newspapers is fair treatment of newspapers by the company. This means the reversal of the old and rapidly disappearing policy of giving no information that can be withheld and establishing a policy of entire frankness, withholding nothing that can properly be supplied for publication.

If those whose duty it is to gather news learn from experience that all reasonable information is truthfully and promptly supplied to them and that it is only in rare cases that their requests are denied, they will learn to depend upon the company, as they ought to be able to depend upon it, for their news, and the stories that get into print will be more accurate and more satisfactory to both the publisher and the corporation.

The first essential for a department of publicity is ability to secure information quickly and accurately. The person in charge should have facilities for reaching every department and branch of the organization.

The range of inquiries touch every phase of railway activity and interest. The head of the department will be called upon to give information concerning operation, construction, equipment, discipline, law, legislation, accounting, finance, plans, policies, accidents, undertakings and occurrences of every description. It is not necessary for the head of a department of publicity to have a very profound knowledge of any particular branch of the business, but he should know a little something about nearly everything that pertains to, or affects, the company.

Next in importance to the ability of the department to get information quickly and accurately is its accessibility to the newspapers at all hours of the day and night. From midnight until about ten o'clock in the morning, there is seldom need of being prepared to furnish information about anything except accidents or other unusual occurrences, but from ten o'clock in the morning up to midnight all sorts of inquiries are received and the department should be prepared to answer them.

The equipment of a department for publicity work need not be elaborate. One man with a telephone connected with all of the departments and stations, a desk and a few chairs for the use of reporters can accomplish considerable valuable work. A large company will require a somewhat more extensive outfit. The writer of this paper is provided with two offices; a private office for himself, and a general office for a stenographer and clerk. Each office has a telephone. There is a small library, a collection of maps and plans, files for clippings, documents, memoranda and correspondence. These offices are open from nine to five o'clock on business days. During the other hours of the day and night, on holidays and Sundays a clerk, to whom all accident reports are made as soon as possible after their occurrence, is on duty and gives information to the newspapers.

The company's effort to cooperate with the newspapers in securing accuracy in stories relating to the company is generally appreciated in the newspaper offices. Inaccurate news accounts are still printed and the company is misrepresented in reports, but there are decidedly less of these objectionable and unwarranted statements than formerly appeared. Uniform accuracy in newspaper reporting is as impossible of accomplishment as the entire elimination of accidents in railway operation. All that can be accomplished in either case is to reduce the unfortunate occurrences to a minimum.

The Boston Elevated Railway Company does comparatively little advertising. The exhibit which has been prepared for this convention is, therefore, not very extensive. It consists of a bird's-eye view of the system on a large poster, a map of the central portion of the system, showing connections and pictures of places of interest reached by it, and a few display newspaper advertisements of trolley trips.

What has been said in this paper relates to publicity from the company's standpoint. An appropriate conclusion to the discussion is a presentation of the same subject from a newspaper standpoint, and this is to be found in the remarks of Mr. Thomas F. Anderson, one of the best known representatives of the press of Boston, made at a meeting of the Massachusetts Street Railway Association last winter.

Mr. Anderson said: "This is an age of publicity, and it is a great mistake for any transportation company or other public service corporation to try to ignore this fact and keep the newspapers and the public in the dark concerning its doings.

"In the nearly twenty-five years that I have been actively engaged in journalistic work a vast change has taken place, not only in the physical make-up and the management of street railways, but in their general relations to the press.

"In the old days, it was sometimes next to impossible for a newspaper man to obtain from the head officials of these companies any authentic information about the company's affairs, no matter of how legitimate public interest it might be, and one of the most dreaded of my 'assignments' in the earlier days of my newspaper work was that of interviewing the taciturn and unapproachable president of one of the larger of these roads.

"How different are the conditions to-day! Twenty or twenty-five years ago the reporters often had extreme difficulty in getting a satisfactory report of the annual meeting of one of these companies, but see what happened here in Boston within a week, in connection with the annual meeting of the Boston Elevated Railway Company.

"Not only was a carefully prepared summary of the company's report and financial statement sent around in advance to all the Boston newspapers, but the company, through its publicity department, even made itself responsible for officially reporting the election of directors and all the other essential details of the meeting. The newspaper reporters and editors didn't even have to do any thinking and the best thing about it all was that the published reports were in exact accordance with the facts. Under such conditions there was, of course, no excuse for inaccuracy.

"Twenty years ago the reporter sent by his city editor to interview a street railway president — frowningly 'grouchy' or smilingly uncommunicative, as the case might be — always went forth on his errand with fear in his heart, and usually was obliged to cool his heels in an outer office awaiting the great man's pleasure.

"To-day he sets forth with lightness of spirit, for he is morally certain that the twentieth century railway magnate will give him the 'glad hand' and perhaps a good cigar; and if he cannot give him the information he seeks he will, at least, send the newspaper man away feeling almost as pleased as if he had secured the desired news.'

"Not only have the managements of our street railways adopted a radically different policy with respect to their personal dealings with representatives of the press, but they have gone even a step farther, in some instances, and established official 'publicity bureaus,' after the manner of the modern steam railroad company.

"Through the medium of these departments, the press is kept in constant and almost instantaneous touch with the affairs of the company, and the president, vice-presidents and general manager of the corporation are each and all relieved of the burden of attending to the wants of a battalion of newsgatherers.

"When I speak of publicity bureaus in this connection I do not mean the departments established by some roads for the special purpose of advertising the facilities and attractions of the road, but those that have been created primarily for the purpose of serving as an official medium of news and news-suggestion between the public and the newspapers.

"The first American street railway company to establish a publicity bureau of this sort was the Boston Elevated Company and to Col. William A. Gaston, who was president of the company at that time, is due credit for this exceedingly happy concession to a legitimate public demand for authentic information.

"The Elevated Company's publicity department was established in 1897, and it grew out of President Gaston's conviction that the public, which furnished the patronage and the dividends of the company, really had some rights in addition to that of riding a certain distance for five cents.

"Another important consideration was that the time of the president was too valuable to be infringed upon very extensively even by newspaper men; and this was probably the determining reason for establishing the bureau.

"Mr. J. Harvey White was selected as the head of the department. At first he devoted only a part of his time to this work, but with the growth of the system, and the increasing popularity of the bureau itself with the newspapers, he was soon obliged to give all his time to the duties. Just now that comes pretty nearly meaning twenty-four hours a day, for he is practically 'on call' at all hours.

"Mr. White has an office of his own in the Elevated Company's building, and has a stenographer and an assistant. His mission in life is not to advertise the company, except as that may come in incidentally to his regular work, but to save the time of President Bancroft — one of the busiest men in New England — and to aid the newspapers in getting authentic news reports about the company, be it changes in policy, accidents, appointments of officials, additions of new rolling stock, or what not.

"His time is given up largely to receiving and talking with reporters who come with every conceivable sort of inquiry, all of which Mr. White is supposed to be in a position to answer off-hand; and when he is not doing this he is preparing special matter to be sent out by himself in the shape of news items of 'special articles.'

"When I called on him the other day he was preparing for the Boston papers an article about the life history of the latest employe to be added to the Elevated Company's pension list; and not only had he obtained and prepared the necessary data, but had sent the company's official photographer to make some photographs of the subject — all of which will later make a readable article that will be appreciated by both the newspapers and the public.

"It is the policy of the Elevated Company — in contrast to the secretive methods of many of the old-time street railways — to give out everything of a news nature that can possibly be construed as legitimate public property; and in the case of accidents, everything except the names of those who are injured or claim to be injured.

"The latter reservation is made for the protection of the company, and to circumvent the enterprising 'ambulance attorneys' who are always around in times of such trouble, and some of whom do not scruple to engineer legal conspiracies against the company. The Elevated Company, like most others, also has a rule forbidding its employes to give to reporters or others any information as to accidents."

PRESIDENT BEGGS:— We have another paper upon this subject by Mr. Warnock. Prior to having that paper read I would announce that it is desired to have the executive heads, those charged with the laying down of policy and the executive management of our companies, meet in the west solarium of the Marlborough-Blenheim Hotel, where we can have a more private and quieter place to meet than here, at three o'clock this afternoon. This meeting is an executive session at which only executive officers of the various companies will be in attendance. That means, of course, the general managers, vice presidents and presidents of the various companies. The meeting is called for the purpose of discussing matters of general policy.

The next order of business is the paper by Mr. A. W. Warnock, entitled "Advertising from the Standpoint of the Street Railway Company." Mr. Warnock is here and will now present his paper.

## ADVERTISING FROM THE STANDPOINT OF THE STREET RAILWAY COMPANY.

By A. W. WARNOCK, *General Passenger Agent,*
Twin City Rapid Transit Co., Minneapolis and St. Paul, Minn.

This is the age of advertising! No one who wishes his business to grow and develop neglects the important feature of publicity.

One of the last industries to adopt this modern business force is the street railway, but these carriers are appreciating that printer's ink, judiciously used, is the power which encourages trolley travel and assists in the delightful work of paying dividends. It is such an axiomatic and proverbial saying "Advertising Pays" I will not take any time to discuss that question. I shall try to suggest some practical means for advertising street railways that may prove interesting.

When I say that advertising pays, of course I mean — it depends. Depends on what you have to offer and how you offer it. But granted you apply the same reasonable business rules to the problem that you would to any other feature of operation, there is no question but that returns will be satisfactory.

I take it what one company thinks and what one company has done will be a far more interesting story to hear than a long line of glittering generalities. So with that end in view, I want to tell you what the Twin City Rapid Transit Company, or the "Twin City Lines," as we are now calling our system, has recently done in the line of publicity.

Two years ago the "Twin City Lines" completed and opened for travel the famous "Great White Way" electric line of eighteen miles from Minneapolis to Lake Minnetonka. This line is now one of the really celebrated electric lines in the United States and has been the means of revolutionizing cottage and picnic life at Lake Minnetonka, "The Lake Beautiful" of the Northwest. With the opening of this line, the company found a great many opportunities for expansion. The fleet of four large steamboats already operated on Lake Minnetonka was purchased and rebuilt. The company also built in its own shops six fast express boats, each seventy feet long and capable of a speed of fifteen miles an hour. The idea of this fleet was to encircle the shores of the lake and build up a summer cottage business for the electric line, as well as to offer transient tourists and excursion parties an opportunity to cruise the lake.

To supply the demand of picnic parties, sixty-five acres on beautiful Big Island were purchased and converted into a most attractive picnic and amusement resort. This island is two miles distant from the terminus of the electric line, and three large ferry boats, which the company built, with a carrying capacity each of a thousand passengers, were put on to perform a shuttle service between the electric line and the park. One of the steam roads which had furnished service between Minneapolis and the lake was leased and electrified, giving the "Twin City Lines" two first-class routes between Minneapolis and the lake. In view of such broad development there was urgent need for the widest publicity in order to secure business, and the general passenger department was formally launched. This department had for its function the development of business for the two lines to Lake Minnetonka, for the fleet of a dozen steamboats, and for Big Island Park, as well as for many other parks and resorts, such as Minnehaha Falls and Lake Harriet in Minneapolis; Phalen and Como Parks and Indian Mounds in St. Paul; Wildwood, on White Bear Lake.

Having outlined our necessity and appreciating that our lines offered unique and magnificent opportunities for exploitation such as are possessed by few electric transportation companies, we undertook a vigorous campaign with the central idea of letting the public know what we had for sale. Our advertising has been along four general lines: Newspapers, folders and pamphlets, car window cards and special advertising. I will briefly relate our experience with each of these methods of advertising.

### NEWSPAPERS.

There has always been a good sentiment existing between the "Twin City Lines" and the local newspapers. The time will probably never come when street railways, or any other public service corporation, will be immune from criticism on the part of the press, and this is a good healthy sign, both for the press and for the roads. I am making a temperate remark when I say that, through and through, by and large, our newspapers, as well as our public, entertain a fine feeling of regard for our company. I think this is due in large part to the high personnel of our management which is broad, progressive and always disposed to do the fair thing. Our company has anticipated what the public wants instead of being urged by them to fulfil their wants, and I think, as you travel the country over, you will find no street car patrons more loyal or more disposed to express superlative praise for their home system than the people of the cities of Minneapolis, St. Paul and Stillwater. I emphasize strongly the feeling between the press and the road because I think it a strong asset that every road should have. The good-will of the press is of incalculable value, and a road should utilize every fair means to secure the support of its newspapers. I mean by this that the relation of the company to the public should be of such a character that in all fairness the newspapers will have a friendly feeling for the company. Criticisms, of course, will be made on the best of service, but the general trend of sentiment should be favorable. There is nothing that appeals to newspapers so strongly as the practice on the part of a public service corporation of taking the public into its confidence, and we have always taken our public into our confidence.

Our newspapers do not accept tickets, or transportation of any kind, from us, and all the advertising we receive from them is paid for by us in cash at full standard rates. We make contracts with all the papers at the beginning of each year for a good round sum, ample to tell the public all about our attractions, as well as sufficient to impress the newspapers that we are eager to give practical expression of our friendship for them by buying liberally of their product. It depends largely on what we have to say as to the amount of space we take. We have had as much as a page in each of the papers to tell of some new feature of our service, and we have taken as small a space as four inches. Our advertising campaign is on practically from May to October, and during those five months we plan to use our entire yearly contract with each paper. Before we systematically undertook advertising, our company would spasmodically give a page advertisement, possibly in the middle of winter, to the various pap their special edition, which, of course, had no advertising value as far as our company was concerned. Since we have adopted a business basis for advertising, we absolutely eschew the special edition and the newspapers are eminently satisfied with the basis we have established.

It is a difficult thing to measure the returns for a transportation company from newspaper advertising. The department store which offers a list of articles in its advertisements one day, can the next day, by actual sales, tell very closely the net result of the advertisement, but in advertising any transportation feature, it is difficult to check up except by the general volume of business that is developing. I am quite convinced, however, that our newspaper advertisements have not only educated people as to what we have to offer, but by exploiting what we are doing and are trying to do, have developed a warm confidence in us and a belief in our intention to serve them.

The good-will of reporters, paragraphers, editorial writers and jokesters on a paper, it seems to me, is of inestimable value to a street railway, and if they poke good-natured fun at your company it is good advertising. I would sooner have our announcements printed in the columns of good, clean newspapers, and carried into the homes of our patrons, then use any other means of educating the people direct. Such advertising can scarcely be properly estimated or appreciated. Beyond question, the more intelligent newspaper advertising you do, the better will be your business. I am making these statements on the assumption that the service you are advertising is as good and possibly better than what you say it is. Personally I feel that our company offers such good service under all conditions that superlative language is warranted and still will be absolutely within the realm of actual truth. If you do not have a good proposition to offer, then make it a good proposition or do not advertise it. The same rules apply to advertising a street railway as to advertising a theater, a department store or any other enterprise. A good article can stand unlimited advertising, a poor one cannot win out in the long run, no matter how much or how good the advertising may be.

### FOLDERS AND PAMPHLETS.

Our company had never issued a folder of its own until it decided to issue the Twin City Trolley Trips folder. We planned to produce the best electric folder that had then been issued. We adopted the regular standard railroad folder as to shape, nine by four inches, and it was to comprise forty-eight pages. The best paper was selected and the best printing company was awarded the work. We went to a great deal of pains to have an attractive birds'-eye view map of our system engraved for four colors. We devoted the entire folder to outlining suggestive trips on our lines, and we neglected no opportunity of indicating to the reader where he or she might go, and what might be seen by traveling on our cars. Small charts indicating exactly where to get on cars and where to get off, and a wealth of pictures with reading matter boiled down as much as possible, was the material we put into this publication. Enclosed in a most attractive cover, we launched our first edition of fifty thousand copies on a breathlessly waiting public. This year we issued the second edition of fifty thousand copies. Our folder has been the model for at least ten other electric folders. Speaking purely from a mechanical standpoint, it was said to be the finest trolley folder ever issued, and we have something like a bushel of letters from prominent officials of steam and electric companies in the United States endorsing this judgment. Wonder was expressed that we issued such a good folder, but there is no wonder about the matter. We have a wonderful proposition of splendid car and boat lines and glorious places to tell about, and the story should be told in the best possible way. Had we not used as good paper or employed as good mechanical means to turn out a folder that would be appreciated and kept by the recipient, I think we would have fallen short of doing something first-class as it should be done.

We instituted a practical compaign of distribution. By advertising to send the folder to any address on receipt of four cents in stamps, we started an avalanche of mail and inquiries that has been coming upon us ever since. I think we have received requests for our folders from prospective visitors living in nearly every state in the Union, as well as in a number of foreign countries. We have the folders on distribution at our ticket offices where copies may be had for the asking. Prospective visitors to the Twin Cities are always eager to secure copies and our large department stores are more than pleased to distribute them from their information bureaus to visitors who have just come to the cities. We have enjoyed the cooperation of not less than fourteen of the largest and best department and stationery stores in the Twin Cities in this matter, and the support and good-will of these stores are a good advertisement for us as they really constitute themselves agencies in our favor.

The returns from folders can be checked pretty closely. That is to say, you can tell more or less accurately whether the folder is a good advertisement or not. On the cars, day after day, I see patrons perusing the pages of these folders and following up special trips which are outlined. Day after day people come into our offices to ask advice as to certain desirable trips marked out which they wish to make, and as some of these trips cost as high as sixty cents per passenger, it can readily be seen that it is profitable to have installed in the home body or stranger's mind the desire to make these journeys.

A trolley folder should be absolutely devoid of advertising matter, except for the company itself. It should be a story of the cities in which it operates, told in such a broad way as to be really a text-book for the cities. It should accurately picture and portray the many beauty spots around the cities whether reached by the cars of the company or not, and altogether, it should breathe a spirit of boosting for the cities it represents in such a way as to command the admiration of the various public and civic clubs which appreciate publicity of this character. The first cost of maps and plates may seem to the uninitiated as severe, but I do not think any money could be better spent in the publication of a folder than for the best paper, ink and engravings. It should be a tourist handbook that reflects, in a strong, clever way, the company it advertises and the cities it describes.

We have also issued an "Airship View of Big Island Park," a twenty-page folder exclusively for Big Island Park. This contains, on one side, a bird's-eye view of Lake Minnetonka and Big Island Park, and is used to create a distinct travel to Lake Minnetonka. The method of distribution is practically the same as for our trolley folder, and we also use it as a means of circularizing all prospective parties to Big Island Park.

A third folder of six pages we issue describes our "Sightseer" car service which we have successfully operated for the past two seasons. This "Sightseer" offers a belt trip of forty miles around the Twin Cities in three and one-half hours for fifty cents, and has been the means of educating strangers and showing them the beauties of two cities, which they could not possibly see on their own account in so short a time and in so comfortable a manner. To each passenger on the "Sightseer" we give a small twenty-four page pamphlet containing the lecture as given by the conductor on the car. This pamphlet serves in a manner to bring to pleasant memory the trip and lecture the passenger has enjoyed.

We issue a complete sixteen-page time table for all our interurban lines, with steamboat schedules and information which strangers need to guide them over our interurban lines. While we issue these time tables in an attractive way typographically, they are printed on inexpensive paper so as to permit of the wildest distribution.

In addition to having prominent stores in the Twin Cities hand out our printed matter, we have our publication on distribution in the folder racks of all the railroad ticket offices and hotels. These racks are controlled by an association of ticket agents of both cities. The ticket agents of all the roads entering the Twin cities have a most friendly feeling towards our company and are always glad to suggest trips and plan little journeys over our lines for strangers who come to their offices with the inevitable inquiry: "How can I spend a few hours before my train leaves?" I have had so many direct evidences of this attention on the part of our railroad ticket friends as to feel that that feature of trolley travel development is worthy of special endeavor.

In the Twin Cities, the telephone companies and Union stations maintain information bureaus, and these also distribute our literature and take an active interest in telling strangers what we have to offer. With such a kindly sentiment toward us on the part of so many different agencies with which the traveling public comes in contact, it can readily be seen that we possess a good-will in a line of publicity that is of immeasurable value.

### CAR WINDOW CARDS.

An attractive feature of our publicity is the use of large cards for the windows of our cars. We use eight windows of each of our standard cars, four on each side. These cards are thirteen by twenty-four inches in size and are fastened on the inside of the upper sash. They are printed in large type on both sides so that they can be read from the inside of the car as well as from the outside, and on these cards we sing the praises of all the lakes, parks and resorts on our lines. One of these cards is devoted to the telling of the adventures of Hi Jinks, the Picnic Person.

Mr. Jinks has had a really remarkable career. We tell each week with a funny cartoon and a verse, the adventures of Mr. Jinks at Big Island Park, and the series of twelve Hi Jinks cards for the season of 1907 has made such a hit as to really be worth passing mention. The first week we had Mr. Jinks making his bow. The second he was hugging himself with delight at the idea that Big Island Park was soon to open. The third week he was packing his picnic basket to go to Big Island Park, etc. Each week he does something new.

We held a competitive contest in which artists prepared this character from the suggestion we outlined of a genial, old bachelor who was out for a good time, and who could appreciate the good things we had to offer at Lake Minnetonka. After the character was finally selected we employed the best lithographers to develop the pictures. The verses were really funny and of such easy rhyme as to be remembered. To illustrate how the Hi Jinks cards have taken with the public I may say that we have had a wealth of poems submitted by patrons from everywhere. Presidents of banks, lumber companies and other large enterprises, as well as clerks, bookkeepers, school teachers and a vast army of other trolley riders suggested verses about Mr. Jinks. Mr. Jinks has become as good an advertisement for the "Twin City Lines" as any vaudeville joke that has made a soap, or breakfast food famous. The compliment has been paid us that Mr. Jinks has Mr. Sunny Jim and Miss Phoebe Snow completely wiped off the map. This, perhaps, is fulsome praise. People have actually been on the lookout for these cards as they appeared every Saturday morning in our cars. We have kept Mr. Jinks entirely in our own cars and he has come to be recognized as one of the distinct officials of our company. Only rarely has he made his appearance in newspaper columns, although the jokesters and the rhymsters on all the daily papers have used him as a mark at which to fire many good natured shots. The career of Mr. Jinks has quite convinced me that people like good-natured advertising with a touch of humor in it. When you get your advertising so serious and so matter of fact that it reads like a complaint in a lawsuit, I should say you were on the wrong track, but when advertising develops a good-natured and kindly feeling on the part of patrons towards you, I believe it is a sure sign that people are paying attention to what you are saying. Next year we have in mind using a sequel for Mr. Jinks, and we expect to make this character lead even a more successful life than he did this year.

While speaking about our car window cards, I should say that most companies have it in their power to use their equipment for advertising in the cheapest and most effective way possible. Street car advertising admits of much display and the use of colors, and appeals to the trolley rider. It always strikes his eye when he is in a receptive mood and this advantage is very great. Street car advertising admits of all the inventive genius one can summon to one's aid and offers an opportunity for the exploitation of new parks, lakes, resorts, opening of new lines and other trolley information which should be given to the public attractively and persistently.

Last year our company adopted an effective trade-mark. It is designed after a Spanish Mission window and is original, attractive and unique. We are using this symbol very generally on all our advertising matter, letter heads, etc. Every road ought to have a distinctive trade-mark.

Right in line with our publicity we have named our famous fleet of boats after cities, towns and resorts on our lines — Como, Excelsior, Harriet, Hopkins, Minneapolis, Minnehaha, Minnetonka, Plymouth, Puritan, Saint Paul, Stillwater and White Bear. Each boat is thus a good advertisement for the place whose name it bears.

### SPECIAL ADVERTISING.

In special advertising, our company has followed two or three lines that have been effective. We had the best landscape photographers photograph our lines from one end to the other, and the most attractive scenes of cars, boats, parks, double-track, wooded grove, shining lake, beautiful meadows and woods have been reproduced by their cameras. These pictures are nine by twelve inches in size and form a collection distinctly in a class by itself. In each of the scenes is shown a bit of track, or one of our cars or boats somewhere in its make-up, and this gives us an advertisement that it is impossible to miss. These reproductions are so good that persons publishing books about the Twin Cities invariably come to us for the loan of them, and as all the photographs are copyrighted, we grant the loans on condition that a line of advertising for our company be printed with the picture, and this is readily done. The photographs are so good that one company issued thirty souvenir post cards in colors, absolutely without expense to us, and report it is the best selling series that it has in its large stock. Furthermore, each card bears a line of advertising for us which was written and put there by us. So much for the great benefit of a fine collection of photographs to any electric transportation company. These photographs have also been used for souvenir stamp books, and the publishers have reported that the sales in that line have been large.

The two maps published by us, one being the bird's-eye view of our entire system, and the other the bird's-eye view of Lake Minnetonka and Big Island Park, are so attractive and they tell such a good story, that every hotel in the Twin Cities, as well as some of the larger business houses, have had them framed and given the best places possible in their rotundas and offices where strangers may see them.

I do not know of any business to-day that offers such strong possibilities for intelligent exploitation as street railways or "Electric Railroads," if you prefer the term. The people generally feel a sense of proprietorship in the street railway when they see its cars running along the street, and take a pride in them that they would not think of entertaining for the commercial railroad with which they come in contact only when they go to the station to meet friends or take a trip. With this sense of proprietorship on the part of the public, it is easy to appeal effectively to your patrons. For ourselves, the "Twin City Lines," offer so many attractions in the way of parks, lakes, falls and other points of interest, that it is really a pleasure to educate the public as to where we can take them and how well we can carry them there. With good feeling existing between the company and the press, with the manifold advantages we possess, and with the desire to do the fair thing on all occasions, our company offers a magnificent field for the most intelligent exploitation. We aim to make our lines the best advertised in all America.

However, as a last word, permit me to suggest to you gentlemen who control the destinies of America's great street and interurban railway interests, when you decide to undertake a campaign of publicity and work with printer's ink, that you select a man who knows his business and understands what he is trying to do for you. Such a man is the only man to prosecute such work for you intelligently, sensibly and effectively, and such a man, like any other skilled workman, is worthy of your widest authority as well as first-class compensation. Gentlemen, I beg of you, do not make the all too common and popular error of thinking that your publicity is in good hands if intrusted to your worthy janitor or to your excellent office boy!

In conclusion let me say from a close personal observation, that these statements apply with equal force to almost every electric transportation company in the country. The ground for this line of endeavor still lies fallow in many communities.

That street and interurban electric railway business can be developed and a fine public spirit engendered by printer's ink properly, intelligently and enthusiastically applied is my profound conviction.

After Mr. Warnock presented his paper, there were so many requests for copies of the "Hi Jinks" verses referred to and shown in the exhibit of the "Twin City Lines," the following specimen verses are printed:

### HI JINKS MAKES HIS BOW.

High Jinks — The Picnic Person —
Makes his initial bow.
Of good time trips by trolley
He'll tell the where and how;
If you would know real pleasure
You should to Hiram hark,
And date your picnic early,
At new *Big Island Park.*

### HI JINKS FINDS IT HARD TO WAIT.

Hi Jinks — The Picnic Person —
He found it hard to wait,
Until the grounds were ready,
Until the Magic Date,
When reveling in wonders,
He'd have a jolly lark,
Enjoying stunts, etc.,
Out at *Big Island Park.*

### HI JINKS WENT TO MINNETONKA.

Hi Jinks — The Pichic Person —
To Minnetonka went,
His fare was but a quarter
And not another cent.
With eager optics gazing
Across the waters dark,
He said: "Soon there'll be doings
Out at *Big Island Park.*"

### HI JINKS WAS CRAZY WITH DELIGHT.

Hi Jinks — The Picnic Person —
Was crazy with delight,
"The Good Time Grounds are open,
I'm going there to-night.
I'm going to hear the music
And also, I remark,
There are other things worth doing
Out at *Big Island Park.*"

### HI JINKS SPED OUT GREAT WHITE WAY.

Hi Jinks — The Picnic Person —
Sped out The Great White Way,
Good track, big cars, fast service,
All won his quick "O. K."
He transferred to the Ferry,
With this well-turned remark:
"If any trip's more pleasant,
I'll eat *Big Island Park.*"

### HI JINKS WAS AN OFF-HAND COOK.

Hi Jinks — The Picnic Person —
  An off-hand cook was he,
As coffee cook for picnics,
  He was " 'Way up in G."
With ranges hot and ample,
  He made his beverage dark,
And not a cent it cost him
  Out at *Big Island Park.*

### HI JINKS HAD AN EAR FOR MUSIC.

Hi Jinks — The Picnic Person —
  For music had an ear;
He found at Minnetonka,
  The best there was to hear,
He sat in the Casino,
  The witching strains to mark,
And hummed the tunes while going,
  Home from *Big Island Park.*

### HI JINKS CHORTLED LOUD IN GLEE.

Hi Jinks — The Picnic Person —
  He chortled loud in glee,
To see his twisted visage
  In the Laughing Gallery.
With body like a porpoise,
  And features like a shark,
He said: "Sure there are wonders,
  Worked at *Big Island Park.*"

### HI JINKS GOES A-BOATING.

Hi Jinks — The Picnic Person —
  Desired to go afloat,
He hired — per hour, one quarter —
  A beauty of a boat.
His cares were soon forgotten,
  And as his graceful barque
Sped on, he cried: "No worries,
  Can haunt *Big Island Park.*"

### HI JINKS BROKE UP GROUCH CLUB.

Hi Jinks — The Picnic Person —
  Broke up the Grouch Club quite;
He took them all to 'Tonka,
  Upon a Summer night.
They rode the Roller Coaster;
  They had an all 'round lark,
And each one came home smiling,
  From "Great" *Big Island Park.*

HI JINKS MAKES THE TRIP IN ONE HOUR.

Hi Jinks — The Picnic Person —
  To Minnetonka hied,
By trolley and by ferry,
  A most delightful ride.
Only one hour from starting,
  It was time to disembark,
It cost him but a quarter,
  To reach *Big Island Park.*

HI JINKS WENT ON AN "EXPRESS."

Hi Jinks — The Picnic Person —
  Found he must cross the lake;
For safety, speed and comfort,
  He knew which way to take.
"Express boats run," said Hiram,
  "To every point and bay,
You shuttle Minnetonka;
  Ten cents a trip each way."

PRESIDENT BEGGS:— The next order of business is the Report of the Committee on Promotion of Traffic, which is along the same general line as the two papers which have been read. The chairman of the Committee, Mr. W. E. Harrington of Pottsville, Pennsylvania, is present and will read the report.

## REPORT OF COMMITTEE ON PROMOTION OF TRAFFIC.

*To the American Street and Interurban Railway Association:*

GENTLEMEN: — The committee on "Promotion of Traffic" respectfully submits this, its second report:

The committee feels that the subject matter in its first report, submitted at the last annual convention at Columbus, Ohio, in 1906 is so full and complete that little is left to enlarge upon.

There are a few subjects of interest which the committee herewith submits:

*Park and Amusement Features.* Just so long as street railway companies own, control or have an interest in parks along their lines the much mooted question as to their desirability from a purely financial point of view will continue to be debated. Last year this committee in the course of a minute investigation into the general subject of "Promotion of Traffic" went into the park proposition thoroughly. Among the questions asked the street railway managers of the country was this: "If you had it to do over again, would you equip and operate a park?" Seventy-four per cent. of the replies were in the affirmative.

While the preponderance of sentiment is thus shown to be in favor of the operation of the parks, it does not by any means necessarily indicate that this seventy-four per cent. of street railway park managers have found that the parks themselves, of themselves, and in themselves have shown a balance on the right side of the ledger. As nearly as can be ascertained a very small percentage of the parks actually pay in their receipts from various sources the cost of operation. What profit exists must be due to the increased traffic on the company's lines in consequence of the exploitation of the park and the exact difference between the additional receipts from this source and the additional cost of the extra transportation facilities that must be provided, is still a matter for individual computation.

As to the actual, practical lay-out, construction and operation of a street railway park, much, almost all, depends upon the local conditions existing in the community in which the park is to be operated. The class of people, their average wage, their hours of labor, their predilections for certain forms of amusement, all must be reckoned with. Therefore no matter how much may be learned from the experience of others, the final test as to the success of a park must lie in the shrewdness of the park manager in adapting his offerings to the wants of his patrons.

As to the question of whether a park should be owned and operated directly by the street railway company management, or should be leased outright, there seems to be a prevalence of opinion that, conditions being favorable, it is more satisfactory in the long run to lease the park outright on a flat rental basis. Where conditions make it unwise to do this the next most satisfactory method seems to be to let as many concessions in the park on a flat rental or percentage basis as is wise.

In some sections of this country it is claimed by some park managers that a park cannot be successfully operated unless liquor is allowed to be sold on the grounds. This is not, however, the experience of the majority, who find that the moment a license of this kind is granted in a park, the general class of patrons and the general tone of the place is lowered. In a short time the better class of people keep away entirely and the park, no matter how well its grounds and attractions are kept up, literally runs down.

The distance that a park should be located from the centre of a community in order to draw the greatest number from that section, has been the subject of much discussion and varying opinions. The majority of managers, however, are of the opinion, and results seems to indicate, that from 2.5 to 6 miles, or a half-hour ride at a five-cent fare is about the most advisable. Of course, in some sections it is possible to draw people from a greater distance, but they are few in comparison.

As to just what form of amusement enterprises should be included as attractions in the parks, experience has shown quite a unanimity.

First of all, it is a strong asset to a park to have it located on the banks of an attractive river, lake, or small pond where the public may enjoy boating and such features. There must be a good up-to-date carousel, a dancing pavilion and some sort of an athletic field. There must be the usual candy, cigar and other booths with a good restaurant where the inner man may be appeased at a small cost. Swings are universally popular, and it must not be forgotten that while the older folks and the male population may crowd the park in the evening, there are some good long hours during the day when business might be done to advantage. For this reason as many features as possible to make it comfortable for the ladies and pleasant for the children, should be installed. If you can get the children interested, you can get their mothers, and sisters and aunts, and they all make riding during a portion of the day when they can be handled very nicely. There should also be some sort of accommodations for picnic parties. The ideal accommodations of this character would include a covered pavilion with tables and chairs where lunches might be comfortably eaten whatever the weather, and some means of warming up coffee, cocoa or other auxiliaries to a lunch would be well received, although regarding this, fire dangers must be considered and perhaps a watchful attendant might be necessary.

As many various sorts of concessions are advisable as the patronage and tastes of the patrons seem to justify. This is another thing that local conditions will have to govern.

Theatres have been found to be about the best of the what might be called special attractions. The majority of the parks have open theatres, as far as the seating space is concerned, but it would undoubtedly be better if a theatre combining the airy coolness of the open theatre and the safety in case of rain, or a covered or closed theatre could be used. This is more expensive, but in the long run would probably justify itself.

The character of the shows presented in these theatres depends upon the community, what they like and what they are most in the habit of seeing during the winter months. It is advisable, if possible, to give them something different from their regular theatrical entertainment. In the majority of parks it has been found that the strong popular preference is for vaudeville shows of five or six good acts. The price of admission varies in these theatres, but it is generally considered that reserved seats should not be over twenty-five cents, and the majority considerably less.

Bands are essential to the full enjoyment of people of this country when seeking out-of-door amusement, and they should be made use of as often as the conditions will permit, Sundays and holidays, or certain days during the week, or every day if the patronage would make it possible to stand the expense. It is also wise to introduce during the season a number of unusual special features, free, and in addition to those that the regular park attractions afford. Of these the most popular seems to be balloon ascensions, but there are baby shows, animal hunts, diving horses and a wide diversity of thrillers that draw crowds at these times and keep people in the habit of looking to the park for their pleasure.

Whatever the attractions and whatever the location and general make-up of the park may be there is one thing that must not be forgotten and cannot be expressed and emphasized too strongly and that is, that the best of order should be maintained at the park, whether by the regular city or town police or by special park officers sworn in as deputies. Nothing gives a park a knock-out blow so quickly as disorder, and the management should go to any length to see that it is quelled in its incipiency.

The general management of a park when operated by a street railway company itself should be vested in one of the company's operating staff, although he may have an assistant manager directly in charge. The final decision, however, should be his.

There is another point which cannot be too strongly considered in the operation of an amusement park by street railway companies, or anyone else, and that is the advertising of that same park. A first-class, well-kept park, nicely located and with an abundance of good attractions will, of itself, attract some people, but only by the most strenuous kind of publicity will it attract enough people to make the venture possible.

How to advertise is the question. How to spend the least money and get the most results. The most expensive advertising is not always the most profitable. Many a business concern has spent millions in advertising and then gone into the hands of its creditors. The advertising which counts is of the character that is seen by the people who are most likely to be attracted by it. That may sound like a self-evident fact, but it is not so self-evident, but that it is often disregarded.

Of all forms of advertising in these modern days it is universally conceded that newspaper advertising stands at the head. This applies to parks as well as to everything else. It must be sharp and to the point, not too niggardly and must be supplemented with attractive reading notices in the regular news columns. Whether all this matter is paid for and how much of it is used depends, of course, on the attitude of the newspapers toward the park management and the cleverness of the advertising man. It must not be forgotten in this matter, as in all others, that newspaper men are a bright, intelligent, self-respecting lot of workers, very sensitive about being used fairly and squarely, as one gentleman should use another, and that they will do more in return for courteous, fair-minded treatment than money can ever procure.

Next to the newspapers and standing almost beside them in importance in park advertising are the cars themselves of the park operating company. The first people to be reached are the people who are in the habit of riding on the trolleys and nowhere may they be better reached than in the cars upon which they ride. These cars also traverse the entire district tributary to the park. It must be found profitable advertising to hang dasher signs upon these cars, signs that have very little reading matter, but which bring out the main attractive features plainly so that all may read.

Another splendid way in which to make use of the company's own facilities is to fix up an old car with bill-boards on each side and cover them with big stands of advertising paper advertising the park, with a proper arrangement of lights so that they may be used at night and then run them continuously over the lines. Advertising cards are also valuable when tacked in the ends of the cars or suspended in frames, where it is possible to do this without infringing on the contract of any advertising concerns. Bill-board advertising is valuable in some sections, but it is doubtful if it is as strong as any of the other methods suggested, and as a rule, should be used merely in a supplementary way.

In this matter of advertising on and in the cars, it may be well to lay special stress on the fact that if this advertising matter is printed it should be religiously used — not on one car but on all. There is a habit among operating men, who feel that their first and almost only duty is to see that the cars are run according to schedule as nearly as possible, of letting a lot of this paper lie around loose in car barns, instead of plastering the cars over with it. It is needless, perhaps to speak of this, but only the most constant and eagle-eyed attention to this matter is sure to bring the results. It must be followed up assiduously or the expenditure will be for naught.

On the whole, investigation seems to show that, given a good park in a good location, in a community capable if sufficiently interested to support a park of this size and character, with good attractions, good order and proper advertising, there should be no reason why the incentive it gives to travel should not make it a profitable venture for a street railway company to promote.

Many small railway properties are not financially able to make large expenditures for parks upon the lines practiced by the larger railway properties, and it has been the experience of not only some small, but some large railways to lease desirable, nicely wooded sites, favorably located, and to build some open air fireplaces, at a cost, say from $10 to $15 and to provide neatly constructed rustic pavilions, and by this means make an attractive spot for picnics and outing parties.

*Base Ball.* The matter of professional base ball as a promoter of traffic is a subject which the committee believes to be worthy of serious consideration. The interest taken by the general public in the national game during the past few years has been growing, as is evidenced by the large number of associations formed in cities varying in population of from 200,000 to 15,000 in the Eastern, Southern and Middle-West States. The information bearing upon this paper is gathered largely from the territory above named.

The large majority of electric railways either operate pleasure parks in connection with their system, or their lines extend to or pass parks of a similar nature, operated by parties interested outside of the railroad. Where the above conditions exist, and the parks are suitably located, it is found advantageous to locate the ball park either in or adjacent to the park grounds, the ball park being either owned or controlled by the railway company. There seems to be no uniform system of leasing the base ball parks, each company apparently handling the matter in the way which would seem advantageous to the road.

Assuming the railroad company controls the base ball park, one of the methods which has worked out satisfactorily is the leasing of the grounds without consideration for a period of years to a local base ball association, the railroad company maintaining it, depending entirely upon the revenue from transportation as its return.

Another method of handling this business which has proved satisfactory in some of the smaller cities, is for the railroad company to form an association of parties whose interest is friendly to the railroad. The grounds are leased to the association for a nominal sum, the association to put the grounds and buildings in condition and furnish uniforms for the ball team. They in return guarantee to keep the grounds in repair, police them and play a stipulated number of games each week during the ball season, which is usually twelve weeks.

The association may be formed from all classes who care to be interested. One of their members is elected as business manager, who, in turn, appoints some college player as manager of the team, which team is largely made up of college students.

During the past few years a number of railroads operating in cities with a population as hereinbefore stated have taken up this subject. They provide suitable and attractive grounds and grandstand, and the financial results derived from the income, after deducting interest and depreciation, have been very gratifying. In several instances where the ball parks are located adjacent to the railroad's pleasure grounds, the income from this sport compares favorably with the best amusements operated.

The committee has given this subject careful study, and the conclusions reached are that street railways operating in a territory where the density of population will support a first-class base ball club, will find it will add considerably to their revenue if the matter is intelligently handled.

As an illustration of the method pursued by the Pottsville Union Traction Company of Pottsville, Pa., herewith is appended the form of contract between the railway company and the representative of the Atlantic League; it is interesting to comment that the earnings from the Base Ball Park exceeded the expectations.

(See Appendix "A.")

*Ice Skating.* The subject of ice skating as a promoter of traffic is one that has been given some consideration by a large number of roads in certain localities. Where rivers and lakes are within easy reach of the street railway lines, due to local conditions, ice skating has been very popular. Where facilities for skaters are located remote from highways of public travel and it is necessary to extend the lines to transport the skaters, the financial results to the road are problematical and in such cases should be given careful thought before the investment is made. Usually places are found on some parts of the existing lines where skating can be had and, if situated in the suburbs, a sufficient number of arc lamps may be erected and operated from the trolley circuit to furnish light for evening skaters.

The cost of keeping the ice in good condition for skaters, and the result of snow, is a subject for serious consideration. In some cases where the income derived from this class of patrons has been very satisfactory, the expenses have been so great as to leave little or no profit.

The committee is of the belief that a railway company is not warranted or justified in making any large investment to care for this source of travel, as the results from this traffic largely depend on weather conditions.

*Special Cars, Excursion Rates, Special Rates.* The committee is at a loss to know how to contribute anything new regarding these subjects in addition to that which was included in the report of the committee last year.

It is the sense of the committee, however, for railways having heavy regular service, not to originate excursions, but to cater to special car service and excursion business planned by others.

*Freight and Express.* The committee has to report that the development of the trolley freight and express business is becoming quite an important factor in the earnings in railway properties in various parts of the United States.

The value of statistics is unquestionable, and in view of the large number of railways now actually carrying on this character of business, we respectfully suggest and recommend the appointment of a committee to report upon "Freight and Express" at the next annual convention; the report to treat upon, particularly, the most desirable methods to be pursued, charges to be made, methods of collection, and, above all, to collate statistics bearing upon the revenue to be obtained from such business and the operating expenses, and finally upon the character of equipment, stations, sidings and terminals.

*Conclusion.* The committee has obtained through the courtesy of the *Street Railway Journal* and the *Electric Railway Review* most valuable indexes of articles bearing upon the various questions affecting the subject matter of your committee's work. The indexes are appended hereto.

Respectfully submitted,  
W. E. Harrington, *Chairman.*  
H. J. Crowley,  
H. E. Reynolds,  
H. F. Grant,  
G. W. Parker,  
*Committee on Promotion of Traffic.*

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## *APPENDIX "A.*

ARTICLES OF AGREEMENT, made and concluded this eighteenth day of December A. D. one thousand nine hundred and six, by and between The Tumbling Run Park Association, party of the first part, and Ernest C. Landgraf, of the city of New York, State of New York, party of the second part, witnesseth that said party of the first part hereby stipu lates and agrees to rent to the party of the second part a certain base ball park located near the premises of the party of the first part in the township of North Manheim, County of Schuylkill and State of Pennsylvania, which park shall be properly fenced and shall contain a grand stand with a seating capacity for five hundred persons and bleachers with seating capacity for six hundred persons. To have and to hold the said base ball park for and during the base ball seasons of 1907 and 1908, together with an option on the part of the party of the second part to renew the lease for longer season upon such terms as the parties hereto may agree upon.

In consideration of the premises, the party of the second part covenants, stipulates and agrees to pay to the party of the first part an annual rental of four hundred and fifty ($450) dollars to be paid in manner following, that is to say, one hundred and fifty dollars on the first day of May, one hundred and fifty dollars on the fifteenth day of June, and one hundred and fifty dollars on the 15th day of July, in each of said two years. The party of the second part also covenants and agrees, as soon as the gross receipts of said park amount to ninety-five hundred dollars, to pay to the party of the first part, as an additional rent, one-half of the excess of the gross receipts over and above ninety-five hundred dollars after deducting from said excess 10 per cent. of the gate receipts for the Atlantic League treasury, and also deducting to pay each visiting club either the sum of fifty dollars or fifty per cent. of the gate receipts, as each visiting club may elect. Such excess of rent shall be paid by the party of the second part to the party of the first part daily after any game or series of games shall have been played.

It is mutually understood and agreed that the base ball park shall be in the form of a rectangle, whose size shall be not less than three hundred and sixty feet by three hundred and eighty feet.

In testimony whereof, the parties hereto have set their hands and seals the day and year first above written.

TUMBLING RUN PARK ASSOCIATION,
W. E. HARRINGTON,
*President.* (Seal.)
ERNEST C. LANDGRAF. (Seal.)

Signed, sealed and delivered in
the presence of us:
(Signed) R. H. KOCH,
(Signed) F. A. HEWETT.
Approved by Counsel,
R. H. KOCH,
12/18/06.

On motion, duly seconded, the report was approved and ordered to be printed in the proceedings of the association.

President Beggs:— We will proceed to the next paper, which is entitled "Problems of the Small Electric Road," by Mr. H. S. Cooper of Galveston, Texas. Mr. Cooper is not present, but is represented by Mr. F. C. Randall of Galveston, who will read the paper.

## PROBLEMS OF THE SMALL ELECTRIC ROAD.

By H. S. Cooper, *Manager,*
Galveston Electric Company, Galveston, Texas.

What is a "small" electric road? What is the measure of its "smallness" ? The gentlemen asking for this paper indicated that their measure was gross earnings, by the fact that they spoke of "companies with less than $500,000 revenue per annum." That is one way of looking at it, but the writer believes that gross earnings is not a *true* measure of a "small" electric road; if $500,000 gross earnings means a "small" road, does $500,001 mean a medium-sized one? And if not, where does the medium-sized one begin and end and the *big* one commence.

Also, at the dividing line of $500,000 — or any other amount larger or smaller — do the "problems" change suddenly — or even to any extent?

And, if a mere arbitrary sum of gross earnings is *not* a proper division line between the "small" road and the one above it, what *is* the proper measure? Is it active track-mileage, or number of cars on regular schedule or population served? It is *not* any one or two or all of these for, if it were, many roads would be in the "small" class which are not considered in it and several so-called "small" ones would jump out of it quickly.

For the purposes of this paper, therefore, an entirely different basis of comparison will be taken, not only because it differentiates the roads in line with the question of "problems," but also gives what the writer believes is a truer division between a "small" road and the class just above it than any arbitrary measurement, financial, numerical, or statistical.

The "small" road is one whose condition is such that it will not allow of *full* departmental organization. That is to say, it is one that, although it might rank out of the "small" class in one or two of the items of gross earnings, track-mileage, rolling stock or population served, yet it is so situated that it is considered it cannot afford to be, cannot be made to be, or *is* not divided into the proper number of clear-cut and non-interfering departments with a competent, *technically* practical man at the head of each. It is in such a "small" road that the manager has to be, *ex-officio,* foreman or superintendent of every department or of most departments; or at any rate, he has to be the *expert* head of departments. It is in such a road that the detail which, in one fully organized into departments, is settled by the head of that department, comes to the manager's desk or calls him away for a visual inspection and a decision. In such a road he must have "a finger in every pie" instead of merely examining or tasting the finished product. With such a road the duties of the manager are not merely managerial; they are not only a combination of the executive, legislative, judicial and administrative, but also paternal and pedagogic. Personally, the sins of every department are directly visited on him, for is he not *it?* To him *personally* come bond and stockholders, the public, the municipality and the employes. He cannot hide behind any department for he may be, or must be, the decisive head of that department. He cannot take refuge behind the impersonality of an office nor a corporation title, for his *personal* responsibility is too well known. Even if he blames matters on a "wicked partner" such as the "Board of Directors" or the "Home Office," everyone knows that it is a subterfuge and, anyway, both of these wicked partners will quickly repudiate the blame and the "last state of that manager shall be worse than the first." This is the *real* mark of the "small" road as it is also its first problem, a problem that begins and ends at home and is a very vital one.

The importance of organization is not fully appreciated by the "small" or "near-small" road. To many owners and managers, organization into departments seems a useless and non-productive process, entailing no revenue and much unnecessary expense, time and labor. To the *very* small road where the manager *is* everything, from engineer to bookkeeper, where the difference between bond interest and deficit is but a hairbreadth, in *such* a road, departmental organization seems — and probably may be — somewhat of a farce. But it must be a *very* small road where this really applies. Simple organization is capable of beginning much lower down in the scale of roads than is commonly practiced among owners and managers, and even a pretty full and complete organization can be started — and will prove remunerative — a great deal sooner than is generally believed.

The simplest organization will have not less than four departments — counting the manager as one of them. These would be:

| | | | |
|---|---|---|---|
| Accounting | Bookkeeping,<br>Car accounting,<br>Purchasing,<br>Correspondence, | Manager and clerk. | |
| Claim department. | Accidents, etc. | Manager and local counsel. | |
| 2. Generating. | Power station. | Chief engineer. | Assistants. |

3. Transportation.— Operating of cars. Inspector, or starter and trainmen.

|  |  |  |  |
|---|---|---|---|
| 4. Maintenance | Rolling stock, | Superintendent | Barnmen, |
|  | Buildings, |  | Shopmen, |
|  | Track, |  | Trackmen, |
|  | Line. |  | Linemen. |

This simplest plan of organization is possible to any road; of course in a *very* small road the manager may have to be the chief engineer and the superintendent of maintenance and of transportation in addition to his other duties, but in *any* road having full business for six to ten regular cars on an urban line or three or four regular cars on an interurban line, the above plan of organization is none too complex.

As we go up in the scale of the smaller roads, or as a road grows in size, these departments can easily and profitably be amplified until it is — for a small road — *fully* organized into departments, which means into about eight, as follows:

1. Accounting and auditing.
2. Claims and legal.
3. Purchasing and stock-room.
4. Power station.
5. Shops.
6. Track.
7. Line.
8. Transportation.

And, if there is a "pleasure park" attachment,

9. Advertising and attractions.

*That* organization — those departments — will answer for a wide scope of sizes of roads. It may be that in the smaller roads the manager will again have to be the virtual head of each department; that the departments will overlap and interfere to some extent, but these are drawbacks only to be amended by increase in size, in earnings or in profits and, if properly carried out, that very organization will aid to that end.

It may seem foolish, when your trackman and lineman are one and the same person, when your winder also repairs trucks, when your carpenter repairs cars and buildings and does pipe-fitting, to ask them to bisect themselves into heads of departments while you show them how you want the work done, and, perhaps, *how to do it;* but, unless you expect your road to be forever stationary as to size, you can afford the foolishness. In the first place, it is good training for both men and manager; it leads to and teaches the proper forms and the proper use of them; it tends to exactitude in work, in authority, in responsibility and in these ways makes far better discipline and more efficient and economical operation. That is the first problem of the small road — to so organize itself that, without waste of time or energy or the unnecessary unreeling of red tape, it will have the advantage of known authority and responsibility from the track-greaser up to the manager.

If the road thinks it is too small for any *real* departmental organization, let it "play at it" with a few simple departments and forms and in a short time that play will develop into earnest. It is good policy in *all* such matters to "go through the motions" for a little while *before* any change is really and actually started. It familiarizes those interested; it brings out faults, deficiencies and objections, and puts the matter into immediate and perfect working order when it *is* made a fixed actuality.

The second and next most important problem of the small road is its direct and personal relation with its patrons, the municipality and — to an extent — the employes. Nothing can be done impersonally. In every move it makes there is a personal motive imputed and a personal feeling engendered. This is compelled to be the case where most of the patrons and all the municipality know the manager and other officials and many of the employes. It is especially the case if there is a local board of directors and it is a wise board, and a blessing in disguise to the manager, if it puts *everything* "up to him," and keeps its skirts clear of all local matters except questions of absolute policy. While a director should *direct,* he should not *meddle* and a "local" director should avoid it as the plague! (This is an "aside").

This personal relation of the small road is not really a hard problem and if it is rightly worked out it can be made an advantage that is well worth the trouble to obtain it. In a comparatively small city, up to 50,000 or 75,000 inhabitants, the city will always regard its street railway as one of its possessions; not merely an adjunct or attribute as in the cosmogony of the big city, but as an object of personal interest or value and in the same category as its other civic improvements. If, therefore, the road can be made in any way a credit to the city, something that it can boast of in some particular, it is a distinct advantage gained for the road.

To obtain such a condition — that most valuable asset of a public service corporation: a pleased and satisfied public — is the next problem of the small road, but to do so needs individual care and tact in a much greater degree than with the larger road, where the public is larger and the inertia, therefore, greater; where the electric road is one of many public utilities and, as a whole, less an object of personal solicitude to the citizen; where its total physical and financial condition, its rights and its franchises are *not* facts known to every taxpayer. In the small roads these are *all* matters of personal interest to the citizen, are discussed in all companies and, as this condition is handled by the road, so will they become aids or hinderances, weapons of offense or defense for the company.

And the simple solution of the matter is: perfect equity between the company, its patrons, the public and the municipality. The personal equation must "cut no ice" in matters general or matters of policy — that policy must be a *straight* business one requiring only the facts that — as a "public utility corporation" it has only one master, the public; only one client, the majority of its patrons, and that its only duty is to serve and keep faith with the one honestly and squarely and to impartially give the other the best service that its patronage allows. To do otherwise is to invite trouble sooner or later; to give service or facilities to *one* section when such are equally due to all, because the company or some of its owners or backers are interested in that section; to show partiality to any class or faction as a means of obtaining its influence — political or financial; to create exceptions in favor of or to allow privileges to individuals because of "pull" or "influence," or "graft," or favoritism are sure breeders of future difficulties in the smaller cities, for they are *personally* known and felt and resented.

To listen courteously and interestedly to the complaints, "kicks," hints and crude suggestions of the patrons and non-patrons of the road, to sift the wheat from the chaff and give due credit and thanks for the few poor grains found, and to pass by the bushels of husks without offense; to meet graft — open or implied — without *open* recognition of it and with an honesty of company policy, purpose and dealings that inoffensively disarms it; to gracefully refuse an improper or impossible request, favor or privilege asked and leave no resentment for the refusal; to explain, excuse, expound, exonerate; to do so as to leave a satisfied or convinced person; to do so as to leave no sting; to do so in a manner to satisfy as to the company's motives and acts — this is the second problem that the small road puts up to its managerial head. And it is no small problem, for it takes unending tact, patience, good humor and a large experience and knowledge of human nature and of all *local* conditions. To convert the enemies and lukewarm friends of the company into partizans for it; to keep its friends friendly; to be courteous, exact and equitable in all matters requiring it and yet to be able to be *liberal* when occasion needs it, to be *lax* when it violates no law, no rule, or no policy and when it creates no precedent — *this* is what the small road exacts from its manager.

The third problem is a material one — one that may be divided into two heads: employes and materials. With the first, the relations of the head of the road are not only those of a — or *the* — superior official. They are, as I have said, pedagogic and paternal. He is seldom, if ever, "The Manager" or "Mr. So-and-So"— he is "The Boss," or "The Old Man," personally known and having a personal influence and example with them. Therefore, much is expected or exacted from him and through him *from the company* that is *not* expected from the larger road where the only "boss" is "Rules and Regulations," or an impersonal official in a swing chair before a flat-top mahogany desk; where the employe is not an *individual* but a *unit* and, in consequence, is treated by a formula with a very small variable in it. The head of the small road has the direct personal equation to meet in his discipline and in his employment. He can not be as independent of his "help" as can his brother of the larger road, for his reserve supply of trained or available men is not as large or as available. It is seldom that the "extra list" of the small road overflows; in fact, it almost always shows a hiatus at the bottom if the company is at all strict in its requirements as to its trainmen. And the small road has to be, or *should* be, *stricter* as to certain requirements than the large ones, especially among its conductors. In the large cities with their steady traffic of — to the company and its employes — *strangers,* the requisites for competent trainmen are, in certain directions, less and less exacting, than for those of the smaller road where a certain courteous attention to and a familiarity on the part of the trainmen with its patrons and their ways is an asset of the transportation department and the company. The public in the larger cities simply desires transportation — *rapid transit* by preference. It doubtless appreciates convenience, comfort and courtesy, but it will sacrifice them all to *speed in transit* and be content with the change. It will not resent being asked to "Get a move on" in boarding or leaving a car; it will "move forward" mechanically when gruffly ordered to do so; it will board or leave moving cars cheerfully and without expecting a helping hand from the conductor; it is generally ready with its fare; it is at the right place to board the car and is ready to step off when the car slows or stops. Now the patrons of the small road do none of these things and, in consequence, the conductor, instead of being a fare-collecting, signal-bell ringing, accident-report-filling automaton, *has* to be a *human*-being with — at least *some* courtesy and tact. These requisites keep the "extra list" of the small road gasping for breath, especially on rush days.

The other departments, with the probable exception of the power plant, are also parts of the same problem. For a large proportion of the year the line, the track, the shops and the barn can be operated with a minimum of crews and yet, at irregular intervals, and perhaps periods of some length, the force of men in one or the other of these departments could be doubled with resulting economy of operation and maintenance.

There are two horns to the dilema, either to keep the force down to a minimum and *busy,* and trust to Providence for no emergency work or for outside aid when that emergency happens; or to keep a larger permanent force than is generally needed and piece out their time with the manufacture of small repair parts, or the building of rolling stock or other apparatus. Where there is a good foundry and machine shop, a good wood-working mill and a fairly good electric-working or repairing shop in the city or within quick reaching distance, the first method may be used, but small cities with such conveniences, capable of doing truck, motor and car-body work are comparatively rare, and in cities that do *not* boast of such it is a better solution of the problem to enlarge the different "gangs" merely as a question of schedule and car-service *insurance.* This, however, is entirely a matter of local conditions of traffic and climate. It is one of the real problems however that confronts nearly every small road, but is one for which no broad generalization can be laid out. Each small road must work it out "for its own hand."

In the same category comes the question of supplies, and repairs and renewal parts. Whether to keep these at an absolute minimum for ordinary conditions and to again trust in Providence, or to carry a reserve or emergency surplus — those are the questions, and they are not as simple as they look. The first means small interest on investment, less stock-room space, less handling, less insurance, less depreciation, and a more rigid economy of use — the latter because everything *must* be made to last to the final minute and under such a strain that the employes *are* more careful and economical in their use. On the other hand such a course means small-quantity purchases at small-quantity high prices and also small-quantity high freight or express rates; it also means a shortage of cars or an uneconomical "patch-up" of cars, line or track when the emergency *does* come.

To carry an emergency surplus means again a case of "insurance of continuity of service" and, as its proper handling will allow the buying of certain things in larger quantities, it means an economy in purchasing. On the other hand, it means an increase in investment, in depreciation and deterioration of certain supplies, and a more lavish use — at any rate a less economical use — unless life and mileages are accurately kept and applied. *That* means considerable additional clerical work for *some* one. The decision of these questions is also a local one, influenced by local traffic and geographical and climatic conditions, by the distance to large commercial centers where such supplies are always in stock and — firstly and lastly — by the financial condition of the road, by its policy and by the balanced judgment of the manager.

For it is to the *actual manager* of the small road — whatever his official title may be — that its success or failure is due. *Its* problems are his problems, his *own* PERSONAL problems much more than in the case of his bigger brother whose every clean-cut department can be capped with a capable head — a congress of whom, or the complete reports from which, gives the big manager a complete and instantaneous grasp of the situation at any minute; gives him a clear, complete and concise report from *experts,* which the small manager must — most often — work up for himself from meager, obscure and empirical information, from imperfect data and his own observation.

But, if he has the breadth, it is a good education for him, and his road profits by it — *for a while.* For *that* is the last problem of the small road, to retain its managerial head if that head is a good one and if he has no *ownership* or profit-sharing financial interest in the road. To the capable manager of the successful small road, the big and the bigger roads are always beckoning, and he waves his hand in reply, for he has his eye on the "seats of the mighty"— the swing-chair and the mahogany desk — and he intends, in time, to be an officer of the National Association. He would like to be one *now,* to attend all its meetings, to write papers for it, to fill out promptly and fully Mr. Swenson's daily "interrogatory sheets"— but how can he? His little road takes his every minute from his early rising to his late retiring, he has to eat it, drink it, sleep it; if not as manager, it calls him as claim agent, accountant, purchasing agent, track or line foreman, winder, car repairer or chief engineer. His public, his patrons, his municipality, his employes, his stockholders, his directors, all seem to study things for him to do to fill in his (*their* idea!) "vacant time." And a week or more absent from it, and a hundred dollars added to "General Office Expense!" What *lots* might happen in a week's absence and how *many* places in track, line, cars or station that hundred dollars would fill. For, of course, he attends his own local or sectional association, is an officer of it, and writes papers, and answers "Question Box" queries for it, *that* is not only a duty but a pleasure. He personally knows every member of it and exchanges ideas and experiences with them; the discussions and papers are nearly all on problems that affect *his* road. The members have always a common interest in local legislation, in peculiar local, climatic, geographical, traffic or legislative conditions. This home association uses up a great deal of his spare time and ideas and of his little company's available expense money. It is often his only "vacation," at any rate the only vacation that he thinks that he and his company can afford.

He *would* like to attend those national meetings, but, in addition to the above reasons, he is somewhat scared of them. The published academic papers and discussion, the high technical and mathematical exactitude of them appall him, while the (well edited!) clear-cut discussions and the authoritative style and "ipse dixit" of the well-known speakers make him feel that even if he *were* there and *knew* that they were wrong, he would not dare to lift up his little voice in protest.

Of course he is wrong, if for no other reason than that the attrition, with larger and broader experiences, would be of benefit to him and his little road, a benefit obtainable in no other way. And he does a wrong to the national association for it needs him and his experiences. His little road is the "dog" on which nature and municipalities and legislatures and the public "try out" their new schemes or renew their old ones. The problems of the large roads are only the problems of the smaller one condensed, intensified, made into a formula by pressure of traffic, by condensation of population, by humanity in the gross instead of in the individual. The large roads *need* the experience of the small one for *its* problems are basic ones, worked out empirically, with travail and by retail, but containing the true *principles* and with those principles open and apparent, so that "he who runs may read."

The national needs the small road — as much or more than the small road needs the national — but how are you going to get them? *That* is a problem of the *big* roads!

President Beggs:— It is already past our hour of adjournment and we still have one paper on our program, that of Mr. Reel on "The Use of the Tee Rail in Cities." A motion to postpone the presentation of this paper until to-morrow's session will be in order.

On motion it was ordered that Mr. Reel's paper be considered at the Friday session.

The meeting then adjourned until Friday morning at 9:30 o'clock.

## FRIDAY MORNING SESSION.

### October 18, 1907.

President Beggs called the meeting to order at 10:00 A. M. in the Sun Parlor on the Steel Pier.

President Beggs:— It has been customary for the chair to appoint a Committee on Resolutions. I will therefore appoint Mr. C. D. Wyman of Seattle, Mr. H. J. Davies of Cleveland, and Mr. C. S. Sergeant of Boston, as a committee to prepare suitable resolutions to be offered before the close of this meeting in order that they may be made a matter of record.

We will now start in on the regular program, which commences with the reports of committees, the first of which is that on insurance. I have the pleasure of introducing to you, Mr. H. J. Davies of Cleveland, chairman of this committee.

## REPORT OF THE COMMITTEE ON INSURANCE.

*To the American Street and Interurban Railway Association:*

Gentlemen.— Your Insurance Committee has held three meetings since its appointment a year ago, has sent one circular letter (with data sheet No. 17) to every member of the association, and to other street railway companies, and has analyzed the data received in response thereto. The filling out of the data sheet involved considerable work, and for this reason, as well as because the subject of insurance still receives less attention from street railway companies than any other part of their business, the number of blanks returned was much smaller than the committee had hoped to receive.

The seventy-odd reports received show insurance premiums amounting to more than $3,000,000, losses of $1,482,600, and payments by the insurance companies of $1,360,000 in adjustment of the losses, or 45 per cent. of the premiums paid, indicating that, while rates on many large properties have been reduced, there is still considerable profit in the business.

A large part of the cost of conducting the insurance business consists of commissions paid to agents, brokers and solicitors. It is evident from these figures that if this item of expense could be eliminated, either by cooperation among traction companies to mutually insure their own properties, or by arrangement with existing insurance companies to do the business directly with the traction companies without the intervention of middlemen, a substantial additional saving in premiums might be obtained.

Of course, if full reports had been received from all the members of the association, the ratio of loss to premiums might have been greater. On the other hand, it might have been smaller. Some of the companies that reported gave figures for only a part of the period called for by the blank. If even these companies had made full report for each of the seven years, the result indicated might have been changed. It may be that all the losses suffered by these companies are not included in their reports; but the large losses suffered by the Baltimore, Cleveland and St. Louis companies within that period are included, and these three losses alone amounted to more than $800,000.

Some of the companies reporting are setting aside from their earnings an insurance reserve or fund, in lieu of insurance, or in addition to insurance. The amounts so set aside are not included in the premiums on which the foregoing calculations are based. If they were included the percentage of loss would be smaller.

Members that did not fill out data sheet No. 17 are urged to do so, and to mail it to Secretary Swenson as soon as possible, so that the association may have the information on file for the benefit of its members.

The committee recommends that the secretary of the association send out a blank, soon after the close of each calendar year, asking the members to give him the data called for by questions 5, 6 and 7 of this year's data sheet, and that he tabulate the information received, so that the association may know at all times the gross cost of insurance, the losses, and the causes of fires. It was very difficult for members to get together all the data asked for by your committee for the seven years covered by the data sheet; it will be comparatively easy for them to make a report for a single year at a time.

Your committee received, in response to its circular letter, more than fifty insurance forms, or descriptions of property. A subcommittee was appointed to make examination and study of these, and to prepare a general form that would aid the members of the association in negotiating for insurance. This work has not yet been completed.

The reports show that the causes of fires have been various — some from lightning, some from defective wiring, some from short-circuits in cars, some from electric heaters, one from the upsetting of a car stove caused by the derailment of a car, one from placing wet horse blankets in an armature oven to dry, and others from other causes. Most of the fires started in cars, and a large portion of the car fires occurred in cars in service on the road. Several of the fires reported occurred in theatres, or other park properties, and one was in a storage warehouse owned, but not occupied, by the street railway company that reported the fire. The losses from these fires are included in our statement of losses, although the properties destroyed or damaged were not, strictly speaking, street railway properties.

After the adjournment of the Columbus convention, President Beggs appointed a committee on car house construction, to consider and make recommendations upon the subject of the building of car houses, with special reference to the prevention of fires, so as to carry out more effectually the suggestion of the Insurance Committee in its report of last year in regard to the importance of the adoption of methods of protecting the buildings and rolling stock of street railway companies from destruction, or damage by fire. That committee has done most excellent work, in collaboration with a similar committee of the National Fire Protection Association.

Responding to suggestions made to the association by representatives of the old-line insurance companies at the Columbus convention, your committee invited the eastern and western associations of those companies to meet with it in New York, at the office of this association, on September 23d. The meeting was attended by Messrs. H. A. Smith, vice-president of the National Fire Insurance Company, Hartford, Conn.; C. G. Smith, secretary of the German-American Insurance Company, New York; C. J. Holman, assistant manager of the Commercial Union Assurance Company of London, New York; R. M. Bissell, vice-president of the Hartford Fire Insurance Company, Hartford, Conn.; E. H. A. Correa, vice-president of the Home Insurance Company, New York; Fred. S. James, western manager of the National Fire Insurance Company, Chicago; Edward Milligan, vice-president of the Phœnix Insurance Company, Hartford, Conn.; J. W. G. Cofran, western manager of the Hartford Fire Insurance Company, Chicago; William Hare, assistant manager of the Norwich Union Fire Insurance Society, New York; J. H. Stoddard, general agent of the New York Underwriters, New York; Bruce E. Loomis, manager of the Fire Underwriters' Electrical Bureau, New York, and three members of your committee.

The Insurance Committee of this association has from the start urged that the prevention of fires was more important, and more economical financially, than the collection of losses. While the work of your committee has brought about reductions in rates, and a more intelligent and careful consideration by traction managers of the subjects of insurance against fire losses and the prevention of such losses, the effect of the work, it is believed, has been greater upon the insurance companies than upon the traction companies. This was made manifest at the meeting of your committee last month. The old-line insurance companies have lately been giving much attention to traction properties. They are coming to look upon them as less hazardous than they had supposed them to be. They have recommended improvements in the construction and protection of many street railway plants. They are treating our properties in a class by themselves. They have done a great deal to educate street railway companies to guard their properties against damage by fire, and a great deal more to educate themselves on this subject, and on the subject of the cost of insuring such properties as a class. They admit that mistakes have been made in the insurance business, as in all businesses; that the business has been too much localized; that it has been difficult to break away from century-old customs and to adopt more modern methods. They propose a more intelligent and expert inspection of traction properties.

The representatives of the companies present at the September meeting of your committee stated that they were ready and able to quote rates which were fair, and which they could convince us were fair; that they were ready to offer inspection and supervision that could not be excelled; that they had substantially completed a new schedule for rating street railway properties which would make like rates upon like properties throughout the country that could not be seriously criticised; that they had made arrangements for an efficient inspection service; that they were devoting more money, more thought and more time to inspection than in former years, and that they much preferred a low rate with a sure, though small, margin of profit, to a high rate, with big margins in certain years, and big losses in other years; that they proposed to keep regularly employed a bureau of experts under the direction of Mr. Bruce E. Loomis to advise street railway companies in regard to construction of buildings, and in regard to devices and means for preventing fires and minimizing losses; that the rates made would include the services of this expert bureau, which would take the place of the numerous inspectors heretofore sent out by insurance companies, so that there should not be variations in recommendations, and so that rates on like properties should be uniform.

Your committee is convinced that these insurance companies are sincere in their statements of willingness to cooperate with the traction companies in improving their risks, and to write insurance at rates that will give them a comparatively small margin of profit. In return for the high-class inspection and supervision, and this reduction in rates, they hope to obtain substantially all the insurance of traction companies, and they think that, with their new machinery and organization, they will be able to furnish good service at a cost lower than the street railway companies can obtain by any other instrumentality.

Your committee is of the opinion that, while this association should acknowledge obligation to the stock insurance companies for their present lively interest in the traction insurance business, and for the efforts they are making to so improve street railway properties as to enable them to reduce rates, the street railway companies of the country should so construct, equip and protect their properties as to invite competition in insurance, and should be prepared to carry all of their own insurance whenever rates are too high, and prepared, at once and at all times, to carry at least enough of their own insurance to make the rates. To this end we recommend most earnestly your support of the insurance companies that have been organized by about thirty of the traction companies. This association ought to have the means of knowing, through its own bureau or through a bureau maintained by an insurance company or insurance companies organized and conducted in the interest solely of street railway companies and not for profit, the exact cost of insurance and the best methods of construction and protection, so as to be able to give intelligent consideration to the rates charged, or asked by the old-line companies, or by other companies, and, if they appear exorbitant, to be able to present reasons why they should be lower.

The action of the stock companies since you began the consideration of the subject of insurance, three years ago, in reducing rates, especially to the companies that have been most active in forming organizations for mutual insurance at cost, indicates, first, the effectiveness of the work of your committee, and, secondly, a determination on the part of the old-line companies to retain the business of the traction companies, even if they have to do some of it at a loss. This is emphasized by their statement to your committee that rates ridiculously low — so low as to show no possibility of profit — have been made to certain street railway companies. Their purpose in making these low rates was to prevent those companies from carrying their own insurance, or from uniting with other companies for mutual insurance at cost. As your committee pointed out last year, rates lower than cost are unwise for both insurer and insured.

The old-line companies express a willingness, even an anxiety, to cooperate with the traction companies to bring about or secure better protection and lower rates of insurance, being actuated, they say, by a desire to benefit the traction companies. The real fact is that they realize that such cooperation and such intelligent treatment of the subject are necessary in order to enable them to retain the business they have, to say nothing of enlarging their lines of insurance. Some of their representatives intimated to your committee that they would be willing to do business with the traction companies at a net profit of ten per cent. of the premium, or even a smaller percentage; but they declined to consider a proposition to return to the policy-holders any net earnings in excess of that profit, and they are unable to eliminate from their expenses the commissions of agents and brokers.

The tendency of the times toward self-insurance is shown by the practice of the United States Steel Corporation, the Pennsylvania, the New York Central and other large steam railroad companies, which carry their own insurance.

The mutual insurance plan recommended by your Insurance Committee has been favorably considered by the Central Electric Railway Association, the National Electric Light Association and the Association of Edison Illuminating Companies, each of which has appointed an insurance committee, with duties similar to those devolving upon this committee.

A great many properties are under-insured. In case of loss on such properties, a part of the loss would have to be sustained by the insured. A lower rate of insurance, to which the figures compiled by your committee indicate that the railway companies, as a whole, are entitled, and which any company that will make the improvements now recommended by most of the insurance companies ought certainly to receive, will enable companies to carry large amounts of insurance for the same amount of premium that they now pay. On the other hand, full valuation of properties, especially of well-protected properties, ought, and is likely, to bring reduced rates. We recommend to the members, therefore, a more careful valuation of their properties for insurance purposes, and that a fund, or reserve, be established to cover losses in excess of valuations — the difference, for illustration, between the 80 per cent. usually carried on certain classes of property and the full value of such property.

The number and value of cars subject to destruction at any one fire are oftentimes too great. If it is essential to the operation of a road that rolling stock of very great aggregate value be stored in one locality, the storage-house or yard should be divided by fire walls, or otherwise, so that a total destruction of the property in any one location, or unit, will not tie up the road, or seriously cripple it. The fewer cars there are in each unit the less will be the likelihood of a disastrous fire, and the lower should be the rate of insurance.

We trust that our work and this report will receive your entire approval.

H. J. DAVIES, *Chairman,*
G. L. ESTABROOK,
A. H. FORD,
CHAS. O. KRUGER,
R. B. STEARNS,
*Committee on Insurance.*

## *Discussion on the Report of the Committee on Insurance.*

PRESIDENT BEGGS:— The question of insurance is one of great importance to most of the companies, and in many cases it receives very little attention. I attach so much importance to this matter of fire insurance that we have in the city of Milwaukee a fire insurance reserve fund of $450,000 of high grade 5 per cent. bonds. The fire underwriters have a wholesome respect for my $450,000 of 5 per cent. bonds, because I am in a position to say that we will not carry our insurance with any company which will not give us a reasonable rate. We are looking forward to the time when we can carry our own insurance and save a very large proportion of this 55 per cent.

Do not be deceived, gentlemen, by carrying away the impression that the fire insurance companies make 55 per cent. profit — that is not the truth. Under no circumstances is over 50 per cent. of the amount paid by the insuring public in any line of business — except in the case of some great catastrophe — returned to the insured. The first draft on every insurance premium which you pay is probably 25 per cent., which goes to the state agent as commission. That must go, and can never come back. The insurance companies cannot pay more than they get and, what they pay must be paid out of the premiums. Then the tax on fire insurance premiums in the state of Wisconsin is about 7 per cent. of the entire amount of premiums paid. Then there is all the expense of the advertising which must be paid for out of the premiums, and in many cases the advertising runs into a very considerable amount of money. The mutual company mentioned in the report of the committee has been organized for the purpose of saving a large portion of these expenses.

If a company has sufficient money in an insurance reserve fund created during a term of years, it can carry its own insurance cheaper than it can be carried by the mutual company, and it can save the expense of helping to maintain that organization. The company which puts itself in a position to carry its own insurance is performing a service to the entire insuring community, because the minute you begin to carry your own insurance, your employes, knowing that fact, are unconsciously just a little more careful around your car houses and other properties.

I hope the members will pardon me for having dwelt on this matter at such length, but it is a subject to which I have given a great deal of attention, and I agree with what the chairman of the committee says, that it is one of the matters which the executive heads of the companies do not give the attention which its importance entitles it to receive.

Mr. Staats:— Two years ago I received an invitation from Mr. Davies, of the Cleveland Electric Railway Company, to attend the convention of the American Street Railway Association, for the purpose of bringing to the attention of the executive committee of your association the advisability of appointing an insurance committee. That was the first step taken. We received very great encouragement from Mr. W. Caryl Ely, who was then president of the association. We returned to Cleveland and at once took steps to organize what are known as the American Railway Insurance Company, the Electric Mutual Insurance Company, and the Traction Mutual Insurance Company with the end in view of interesting the members of this association in carrying their own insurance at actual cost. Your president, Mr. Beggs, spoke quite fully upon this subject a year ago at the convention in Columbus. Insurance is a fixed charge and you cannot get away from it. Now, the idea is to make that fixed charge as low as may be practicable, and I claim that it can be done better through your own organization than it can be done through an organization of companies whose only interest is to make the largest amount of money on the capital invested. When you deal with the old-line companies you are dealing with companies that put up their money for a specific object. Do not misunderstand me; I am not running down old-line companies. They have a very necessary place in the community, and we need them, but I say that through cooperation on the part of this association with other associations, you can carry your insurance at actual cost, and that cost will be less than the old-line or stock insurance companies can carry it.

President Beggs:— We will be pleased to hear from Mr. Loomis, of New York City.

Mr. Loomis:— I feel that the subject has been very fully covered at our meetings with the insurance companies, and I have not anything in particular to add, except to say that the stock insurance companies are more than willing to stand by anything they have said so far.

President Beggs:— We will have the report of the Committee on Construction of Standard Railway Car Storage and Operating Houses. Mr. E. J. Cook of Rochester, who is a member of this committee, will present the report.

# REPORT OF THE COMMITTEE ON CONSTRUCTION OF STANDARD RAILWAY CAR STORAGE AND OPERATING HOUSES.

*To the American Street and Interurban Railway Association:*

GENTLEMEN: — Your committee appointed to consider the subject of the "Construction of Standard Railway Car Storage and Operating Houses" held two meetings in conjunction with a similar committee appointed by the National Fire Protection Association.

One of these meetings was held in New York on May 21, 1907, at the association's headquarters. All the members of your committee were present at that time and received a report from the committee of the National Fire Protection Association, covering rules for the construction of buildings of this character.

After a thorough consideration of the rules submitted, your committee made a number of changes and suggestions which were then submitted to the committee of the National Fire Protection Association. These suggestions and corrections were, in turn, submitted by this last named committee to their association at meetings held in New York on May 22, 23 and 24, 1907, and the suggestions made by your committee were practically agreed to.

The second meeting was held in Baltimore on September 19, at which Messrs. Porter, Pumfrey, Parker and Adams were present, representing the American Street and Interurban Railway Association, and Messrs. Patton and Townsend, representing the National Fire Protection Association.

At this meeting the rules and regulations for the construction of car houses which follow were finally agreed upon. These rules have received the approval of the National Fire Protection Association and they are respectfully submitted by this committee to the association for consideration.

H. H. ADAMS, *Chairman.*
A. V. PORTER,
E. J. COOK,
E. L. PARKER,
CHAS. F. FERRIN,
THOS. PUMFREY,
*Committee on Construction of Standard Railway Car Storage and Operating Houses.*

## REQUIREMENTS FOR THE CONSTRUCTION OF STANDARD RAILWAY CAR STORAGE AND OPERATING HOUSES.

A standard Railway Car Storage House should be so constructed and protected that it may not contribute in any manner toward the spread of fire therein, and contribute only, in case of fire, not to exceed sectional losses of the structure. One single division should not exceed dimensions to expose to any one fire a greater number of cars therein than would represent a valuation of $200,000 of combustible rolling stock, or a total interior trackage of not more than 1,800 feet.

(*Note.* The following are recommendations from the standpoint of fire protection only, and are in no way intended as a detailed guide to architects, or mill engineers, with reference to the actual strength which any building may require due to size or occupancy.)

### SECTION I, WALLS.

Walls to be of good hard burned brick, laid in best of lime and cement mortar. (Concrete construction is not covered under this specification.)

(*a*) *Outside Walls.* To be not less than 12 inches thick, and when walls are over 60 feet in length, to be strengthened by piers or pilasters not less than 20 by 20 inches, spaced not over 20 feet, center to center, the walls between piers being not less than 12 inches thick. When without piers to be not less than 16 inches thick.

Where exposed, to be carried full thickness of wall, at least 5 feet above roof, and to be provided with a durable and non-combustible coping. Where roof is of fire-resistive construction, walls to extend to roof. If exposed, walls to be solid, or any openings therein to be protected in a standard manner.

(*b*) *Cut-Off of Division Walls of Fire Sections.* To be not less than 12 inches thick, and when walls are over 60 feet in length, to be strengethened by piers, or pilasters, not less than 20 by 20 inches, spaced not over 20 feet, center to center, the walls between piers to be not less than 12 inches thick. When without piers to be not less than 16 inches thick.

To be not less than 5 feet parapet, carried full thickness, projecting through and beyond cornice eight inches, with a durable and non-combustible coping. Where roof is of fire-resistive construction parapet may be modified.

To be no openings in division walls separating car storage sections, except that for every 100 feet of length, there may be one opening in the wall, of an area not exceeding 28 square feet, the same to be protected with a standard automatic sliding fire door on each side of wall. End walls to have no openings within 5 feet of division walls.

### SECTION 2, HEIGHT.

One story, without basement or space below, except at pits. Height of walls not to exceed 20 feet at eaves line, or 25 feet at peak of roof above the floor level, the slope being from one-half inch to one inch per foot.

*Note.* Where it is necessary to exceed 25 feet in height, this may be increased by permission of inspection departments having jurisdiction, but in no case should this height exceed 30 feet.

### SECTION 3, AREA.

Sections between standard cut-off, or division walls, to contain not over 20,000 square feet of floor area. Distance betweeen centers of adjacent tracks to be not more than 12 feet or less than 10 feet.

### SECTION 4, ROOF AND ROOF SUPPORTS.

(*a*) *Post or Column Covering.* (*When of fire-resistive type.*) All vertical metal supports to be insulated by not less than four inches of concrete, or of terra-cotta, or of such other approved insulating material as is recommended in the Building Code of the National Board of Fire Underwriters, independent of any air space next to the metal. Well laid brick is strongly preferred for column covering.

(*b*) *Girder and Beam Covering.* (*When of fire-resistive type.*) All metal girders and beams to be insulated on the sides by not less than four inches, and on the top and bottom by not less than two inches of concrete, or of terra-cotta, or of such other approved insulating material as is recommended in the Building Code of the National Board of Fire Underwriters.

*Note* 1. No plaster of Paris or lime mortar shall be used for the purpose of insulating material, nor shall any plaster, whether or not on metal lathing, be considered a part of the covering required.

No single block or unit of insulating material used for column covering shall have a greater vertical dimension than 12 inches when placed in position, nor shall the shells and web of hollow tile or terra-cotta blocks be less than 1 inch in thickness, and these blocks shall be well laid up with Portland cement mortar, and the said blocks be suitably tied or anchored together.

*Note* 2. The quality, design and weight of all metal structural parts and supports, the necessary tie rods, bearing plates, wall templates, and the riveting, bolting, connecting, and anchoring of structural parts, to be in accordance with requirements as recommended in the Building Code of the National Board of Fire Underwriters.

(*c*) *Roof.* (*When of fire-resistive type.*) To be of an approved system of brick, concrete or terra-cotta, or other non-combustible material, with approved insulation of special supports or tie rods, as recommended in the Building Code of the National Board of Fire Underwriters for such purpose. Roof covering to be tar and gravel or approved composition.

(*d*) *Roof and Roof Supports.* (*When of slow burning type.*) Roof planking to be not less than 3-in. spliced timber. To have timbers (preferably single stick) not less than 6 by 12 inches, spaced not less than 6, nor more than 10 feet on centers, supported by wooden posts, not less than 10 by 10 inches, and without trusses. Where roof timbers enter walls at opposite side, they should be self-releasing, and have at least 8 inches of brick work between ends of beams. To be without monitors. Roof covering to be of tar and gravel or approved composition.

### SECTION 5, SKYLIGHTS AND VENTILATORS.

Skylights to be of flat type, wired glass and metal frames, constructed in accordance with the rules and requirements of the National Board of Fire Underwriters covering their installation. Ventilators, if any, to be of metal.

*Note.* It is advisable to provide skylights with fuse-releasing attachments, in order that in case of fire skylights may open and carry off heat and smoke. A metal ventilator set in each skylight is also advisable.

### SECTION 6, CORNICE.

Cornice, if any, to be of non-combustible material and plain finish.

### SECTION 7, FINISH.

Finish (interior trim), if any, to be non-combustible and without concealed space.

### SECTION 8, FLOORS.

To be of brick, concrete, stone, cinders or earth.

### SECTION 9, PITS.

To have brick, stone or concrete retaining walls or piers; brick or concrete floors; steps of stone, concrete or iron; the rails to be supported on brick, stone, concrete or wood stringers exposed on one side only, and to have not more than four track sections communicating.

### SECTION 10, TRACKS.

To run clear from building, without break or transfer table. To be terminated by suitable bumpers, so that there will be a clear space of not less than three feet between bumpers and wall of building. Special track work in front of building to be provided with guard rails, where necessary.

### SECTION 11, TRACK DOORS.

Track doors to be in pairs. to be arranged so that whether open or closed any door of one pair will not interfere with the operation of any other pair. When within 10 feet of cut-off walls, to be constructed and hung as for a standard swinging fire door. Approved metal roller doors may also be used.

### SECTION 12, HAZARDS.

All electrical, heating, power and occupancy hazards to be installed and maintained, and where necessary to be cut off, to be in accordance with the rules and requirements of the National Board of Fire Underwriters, as published in specific pamphlets by the National Fire Protection Association.

### SECTION 13, EXPOSURES.

Buildings should be so located that there may be but a minimum exposure only from other property.

### SECTION 14, REINFORCED CONCRETE OR CONCRETE STEEL CONSTRUCTED BUILDINGS

Reinforced concrete construction may be accepted in instances where tests and inspections of the material and structural supports are properly made under provisions as set forth in section 110, pages 153 to 159 of the Building Code of the National Board of Fire Underwriters, prescribed as follows, viz.:

### *Section 110 of the Building Code.*

### *Reinforced Concrete or Concrete-Steel Constructed Buildings.*

**Definition.**

The term "reinforced concrete" or "concrete-steel" in this section shall be understood to mean an approved concrete mixture reinforced by steel of any shape, so combined that the steel will take up the tensional stresses and assist in the resistance to shear.

**Design to be accepted.**

**Component parts.**

**Insulation.**

Reinforced concrete construction may be accepted for fireproof buildings, if designed as hereinafter prescribed; provided, that the aggregate for such concrete shall be hard-burned broken bricks, or terra-cotta, clean furnace clinkers, entirely free of combustible matter, clean broken stone, or furnace slag, or clean gravel, together with clean siliceous sand, if sand is required to produce a close and dense mixture; and provided, further, that the minimum thickness of concrete surrounding and reinforcing members one-quarter inch or less in diameter shall be one inch; and for members heavier than one-quarter inch the minimum thickness of protecting concrete shall be four diameters, taking that diameter, in the event of bars of other than circular cross-section, which lies in the direction in which the thickness of the concrete is measured; but no protecting concrete need be more than four inches thick for bars of any size; and provided, further, that all columns and girders of reinforced concrete shall have at least one inch of material on all exposed surfaces over and above that required for structural purposes; and all beams and floor slabs shall have at least three-quarters inch of such surplus material for fire-resisting purposes; but this shall not be construed as increasing the total thickness of protecting concrete as herein specified.

All the requirements herein specified for protection of steel and for fire-resisting purposes shall apply to reinforced concrete filling between rolled-steel beams. as well as to reinforced concrete beams and to entire structures in reinforced concrete. Any concrete structure or the floor filling in same reinforced or otherwise, which may be erected on a permanent centering of sheet metal, of metal lathing and curved bars or a metal centering of any other form, must be strong enough to carry its loads without assistance from the centering, unless the concrete is so applied as to protect the centering as herein specified for metal reinforcement.

**Centering.**

**Plaster covering insufficient.**

Exposed metal centering or exposed metal of any kind will not be considered a factor in the strength of any part of any concrete structure, and a plaster finish applied over the metal shall not be deemed sufficient protection.

**Mixing.**

All concrete for reinforced concrete construction whenever used in such buildings must be mixed in a machine which mixes one complete batch at a time, and entirely discharges it before another is introduced. At least twenty-five complete revolutions must be made at such a rate as to turn the concrete over at least once in each revolution for each batch.

**Detail drawings to be filed.**

Before permission to erect any concrete-steel structure is issued, complete drawings and specifications shall be filed with the Commissioner of Buildings, showing all details of the construction, the size and position of all reinforcing rods, stirrups, etc., and giving the composition of the concrete.

**Superintendence of work.**

The execution of work shall be performed by workmen under the direct supervision of a competent foreman or superintendent.

**Forms and centering for concrete.**

All forms and centering for concrete shall be built plumb and in a substantial manner with inside surfaces smooth and made tight so that no part of the concrete mixture shall leak out through joints, cracks or holes, and after completion shall be thoroughly cleaned out, removing shavings, chips, pieces of wood and other material, which should not be permitted in forms.

**Placing reinforcing steel.**

The reinforcing steel shall be accurately located in the forms and secured against displacement while the concrete is being placed and tamped.

**Concrete to be used as soon as mixed.**

Concrete shall be placed in forms as soon as practicable after mixing, and in all cases immediately after the addition of water.

**Joints in concrete.**

Whenever fresh concrete joins concrete that is set, or partially set, the surface of the old concrete shall be roughened, cleaned and thoroughly slushed with a grout of neat cement and water.

**Precaution against freezing of concrete.**

Concrete shall not be installed in freezing weather; such weather shall be taken to mean a temperature of thirty-two degrees Fahrenheit or lower; concrete shall not be allowed to freeze after being put in place, and, if frozen, shall be removed.

**Removal of forms and centering.**

The time at which forms and centering may safely be removed will vary from twenty-four hours to sixty days, depending upon temperature and other atmospheric conditions of the weather; the time for such removal to be determined by the Commissioner of Buildings.

**Concrete.**

**Tests.**

The concrete shall be mixed in the proportions of one of cement, two of sand and four of other aggregates as before provided; or the proportions may be such that the resistance of the concrete to crushing shall not be less than 2,000 pounds per square inch after hardening for twenty-eight days, but for reinforced or plain concrete columns the mixture shall not be leaner than one part of cement, two of sand and five of the coarser aggregate in any case. The tests to determine this value must be made under the direction of the Commissioner of Buildings. The concrete used in concrete-steel construction must be what is usually known as a "wet" mixture.

**Portland cements.**

**Strength of cements.**

Only high-grade Portland cement shall be permitted in reinforced concrete or concrete-steel constructed buildings. Such cements, when tested neat, shall, after one day in air, develop a tensile strength of at least 300 pounds per square inch; and after one day in air and six days in water shall develop a tensile strength of at least 500 pounds per square inch; and after one day in air and twenty-seven days in water shall develop a tensile strength of at least 600 pounds per square inch. Other tests, as to fineness. constancy or volume, etc., made in accordance with the standard methods prescribed by the American Society of Civil Engineers, may, from time to time, be prescribed by the Commissioner of Buildings.

**Sand.**

The sand to be used must be clean, sharp grit sand, free from loam or dirt and shall not be finer than the standard sample kept in the Department of Buildings.

**Stone or other aggregates.**

The stone used in the concrete shall be a clean, broken stone, of a size that will pass through a three-quarter inch ring, or good gravel may be used in the same proportion as broken stone, or broken hard bricks, or terra-cotta, or furnace slag, or hard clean clinkers may be used.

**Steel.**

The steel shall meet the requirements of Section 21 of this Code.

### *Section 21 of the Building Code.*

### *Structural Material.*

**Quality and strength.**

*Wrought Iron.* All wrought iron shall be uniform in character, fibrous, tough and ductile. It shall have an ultimate tensile resistance of not less than 48,000 pounds per square inch, an elastic limit of not less than 24,000 pounds per square inch, and an elongation of twenty per cent. in eight inches, when tested in small specimens.

**Quality and strength.**

*Steel.* All structural steel shall have an ultimate tensile strength of from 54,000 to 64,000 pounds per square inch. Its elastic limit shall be not less than 32,000 pounds per square inch and test specimens, ruptured in tension, must show a minimum elongation of not less than 20 per cent. in eight inches. Rivet steel shall have an ultimate strength of from 50,000 to 58,000 pounds per square inch.

**Quality.**

*Cast Steel.* Shall be made of open hearth steel containing one-quarter to one-half per cent. of carbon, not over eight one-hundredths of one per cent. of phosphorous and shall be practically free from blow holes.

**Quality and strength.**

*Cast Iron.* Shall be of good foundry mixture producing a clean, tough, gray iron. Sample bars five feet long, one inch square, cast in sand molds, placed on supports four feet six inches apart, shall bear a central load of 450 pounds before breaking. Castings shall be free of serious blow holes, cinder spots, and cold shuts. Ultimate tensile strength shall be not less than 16,000 pounds per square inch when tested in small specimens.

**Design** Concrete-steel shall be designed in accordance with the following assumptions and requirements:

(1) The adhesion between the concrete and the steel is sufficient to make the two materials act together; the unit value of the adhesion is at least equal to the unit shearing strength of concrete.

(2) The design shall be based on the assumption of a load four times as great as the total working load (ordinary dead load plus ordinary live loads) producing a stress in the steel equal to the elastic limit, and a stress in the concrete equal to two thousand pounds per square inch.

(3) The modulus of elasticity of concrete at two thousand pounds per square inch is equal to one-eighteenth of the modulus of elasticity of steel.

(4) The steel takes all the tensile stress.

(5) The stress-strain curve of concrete in compression, when the stress in the extreme fibre is two thousand pounds per square inch, may be assumed.

(a) As a straight line.

(b) As a parabola with its axis vertical and its vertex on the neutral axis of the beam, girder or slab, or

(c) As an empirical curve with an area one-quarter greater than if it were a straight line, and with its centre of gravity at the same height as that of the parabolic area assumed in (b).

**Flexure.** (6) The assumption belonging to the common theory of flexure, where not modified by any of the foregoing, will apply.

**Stresses.** In the design of structures involving reinforced concrete girders and beams, as well as slabs, the girders and beams shall be treated as T-beams, with a portion of the slab acting as flange, in each case. The portion of the slab so acting shall be determined by assuming that in any horizontal-plane section of the flange, the stresses are distributed as the ordinates of a parabola, with its vertex in the stress-strain curve and with its axis in a longitudinal vertical plane through the centre of the rib of the T.

**Shearing strength.** The shearing strength of concrete, corresponding to a comprehensive strength of two thousand pounds per square inch, shall be assumed at two hundred pounds per square inch.

**Transmission of loads.** All reinforced concrete T-beams must be reinforced against the shearing stress along the plane of junction of the rib and the flange. Where reinforced concrete girders carry reinforced concrete beams, the portion of the floor slab acting as flange to the girder must be reinforced with bars near the top at right angles to the girder, to enable it to transmit local loads directly to the girder and not through the beams, thus avoiding an integration of compressive stresses due to simultaneous action as floor slab and girder flange.

**Indirect compression.** Concrete indirect compression shall not be stressed, under the working load, more than three hundred and fifty pounds per square inch. Reinforced compression members shall be designed on the assumption that this stress in the concrete will be simultaneous with one of six

**Hooped concrete.**

thousand pounds per square inch in the steel. Should the use of hooped concrete be proposed, the working stresses will be a subject for special consideration by the Commissioner of Buildings.

**Field work.**

In the execution of work in the field, work must be so carried on that the ribs of all girders and beams shall be monolithic with the floor slab.

**Joints.**

In all reinforced concrete structures. special care must be taken with the design of joints to provide against local stresses and secondary stresses due to the continuity of the structure.

**Bending moments.**

In the determination of the bending moments due to the external forces, beams and girders shall be considered as simply supported at the ends, no allowance being made for continuous construction over supports. Floor plates, when constructed continuous and when provided with reinforcement at top of plate over the supports, may be treated as continuous beams, the bending moment for uniformly distributed loads being taken at not less than $\frac{W\ L}{10}$; the bending moment may be taken at $\frac{W\ L}{20}$ in the case of square floor plates which are reinforced in both directions and supported on all sides.

**Shearing stresses.**

When the shearing stresses developed in any part of a reinforced concrete or concrete-steel constructed building exceed under the multiplied loads the shearing strength as fixed in this Section, a sufficient amount of steel shall be introduced in such a position that the deficiency in the resistance to shear is overcome.

**Additional provision.**

When the safe limit of adhesion between the concrete and steel is exceeded, provision must be made for transmitting the strength of the steel to the concrete.

**Use for columns.**

**Rods to be tied together.**

Concrete-steel may be used for columns in which the ratio of length to least side or diameter does not exceed twelve. The reinforcing rods must be tied together at intervals of not more than the least side or diameter of the column.

**Load tests.**

**What tests must show.**

The contractor must be prepared to make load tests on any portion of a reinforced concrete or concrete-steel constructed building within a reasonable time after erection as often as may be required by the Commissioner of Buildings. The tests must show that the construction will sustain a load with a factor of safety for floors and structural members as required by Section 136 of this Code, viz.:

### *Section 136 of the Building Code.*
### *Factors of Safety.*

**When not prescribed.**

Where the unit stress for any material is not prescribed in this Code the relation of allowable unit stress to ultimate strength shall be—

**For metals.**

As one to four for metals, subjected to tension or transverse stress;

**For timber.**

As one to six for timber,

**For masonry work.**

And as one to ten for natural or artificial stones and brick or stone masonry.

**Working stresses prescribed by Code.**

But wherever working stresses are prescribed in this Code, varying the factors of safety herein above given, the said working stresses shall be used.

## RULES AND REQUIREMENTS FOR INSTALLATION OF AUTOMATIC SPRINKLER EQUIPMENT IN RAILWAY CAR STORAGE HOUSES.

The rules and requirements of the National Board of Fire Underwriters for sprinkler equipments, automatic and open systems, as recommended by the National Fire Protection Association in published edition of 1905 (or as may be covered by later issues), are to be observed in protecting this class of property, and in addition thereto the special features as herein recommended are to apply.

Attention is also called to the necessity of sub-dividing the areas of street railway property, so that an excessive amount of value shall not be exposed to any one fire.

### SECTION 1, CEILING CURTAINS.

Permanent ceiling curtains are recommended in buildings having a height of over 25 feet from floor to ceiling. These curtains may be constructed of non-combustible material, or of not less than 1-inch tongued and grooved boards, coated on both sides with non-inflammable paint; curtains to sub-divide ceiling into pocket areas not exceeding 5,000 square feet each, and be of a depth from ceiling to trolley wire. Underwriters having jurisdiction should be consulted as regards the specific location of these curtains.

### SECTION 2, AISLE SPRINKLERS.

(a) In addition to the regular ceiling installation, sprinklers to be placed on both sides of each track, in an upright position, on horizontal pipe lines parallel with tracks, and to be so located that water will spray directly into cars through side windows of car bodies; the sprinklers to be at such a height that their deflectors will be from two to four inches below the upper sash rail of car windows.

(b) Distance between sprinklers on aisle lines not to exceed 8 feet.

(c) The standard pipe schedule to govern installation of aisle lines, except that no pipe smaller than one inch to be used.

(d) When the distance between sides of cars on adjacent tracks does not exceed 4 feet, one line of sprinklers to be placed in the center of each aisle between tracks.

(e) When the distance between sides of cars on adjacent tracks exceeds 4 feet, two lines of sprinklers to be installed. Sprinklers to be placed not less than 6 inches nor more than 12 inches from the sides of cars to be protected.

*Note.* When the distance between the sides of cars in adjacent tracks is less than 12 inches, or where aisle lines in accordance with this section may not be practicable, as at curves, switches, transfer tables, car elevators, repair and paint shops, special instructions from underwriters having jurisdiction should be obtained as regards installing raised or altered lines.

(f) Sprinklers to be placed between cars and partitions, division or outer walls, not less than 6 inches nor more than 12 inches from the sides of cars to be protected.

(g) Sprinklers on all aisle lines to be staggered spaced.

*Note.* It is recommended that aisle sprinklers be provided with a shield to protect them from spray of overhead sprinklers and to serve as a means of banking heat waves. Underwriters having jurisdiction should in all cases be consulted as to whether or not these shields should be provided.

### SECTION 3, SUPPLY MAINS TO AISLE SPRINKLERS.

(a) Aisle sprinklers to be supplied through independent connection from main risers, taken from above and close to dry pipe valves; shut-off valves to be provided for ceiling and aisle systems, so arranged that either may be controlled independently.

*Note.* Ceiling and aisle systems should preferably be installed upon separate dry valves.

(b) Aisle lines not to be supported by nor connected to ceiling sprinkler piping. Special hangers, or supports, to be provided that aisle lines may be rigidly secure.

(c) Ceiling sprinkler lines to be protected against contact with trolley poles.

### SECTION 4, PITS AND UNDER FLOOR SPACE.

Where the under floor space does not communicate with the pits, is tightly enclosed, and is not used for any purpose, sprinklers may be omitted in such under floor space by special consent, in each instance, of the underwriters having jurisdiction.

### SECTION 5, ADDITIONAL HAND FIRE APPLIANCES.

Auxiliary hand fire appliances are deemed essential, as fires within car bodies must not be expected to be extinguished minutely by sprinklers, and the following equipment should be provided:

(a) *Extinguishers.* To be one approved and labeled three-gallon chemical fire extinguisher for each 2,500 square feet of floor area; extinguishers to be uniformly distributed in permanent locations.

(b) *Sand Pails.* In rooms containing pits, or where any wiping up or cleaning is done, to be six pails to each 2,500 square feet of floor area. Pails to be of galvanized iron, painted red, with the word "*Fire*" in black letters 3 inches long. Pails to be of three gallons capacity and provided with scoops.

(c) *Small Hose.* Fifty feet of one and one-half inch approved linen hose to be provided for each 6,000 square feet of floor area. Hose to be provided with three-eighth inch nozzle, and to be in lengths of not over 50 feet, the same to be kept folded and attached to a 2-inch

**stand-pipe, which shall have an adequate supply of water at not less than 50 pounds pressure.**

**Where an approved water supply is not available and building has not over 12,000 square feet of floor area, additional approved and labeled chemical extinguishers may be accepted in place of each hose connection.**

***Note.* Underwriters having jurisdiction should be consulted as to stand pipe and hose layouts.**

President Beggs:— Gentlemen, this is a matter in connection with the general subject of fire insurance. This special committee was appointed to confer with a similar committee from the National Fire Protection Association, and I think some very good work has been done. This report only reflects but a very small amount of the work actually done by the committee.

Mr. Staats:— As a member of the Car House Committee of the National Fire Protection Association, I worked with your committee on this subject of standard car houses, and I know that a great deal of time was given by our committee, in conference with your own committee, to this subject. I think it will inure to the benefit of all members of this association who will adhere to the rules and specifications, and I would therefore move the adoption of the report of the committee.

Mr. Sweetland:— Mr. President, before the motion is put, I would like to say a word. Mr. C. H. Patten, the chairman of the Committee on Car Houses of the National Fire Protection Association, was unable to be present at this meeting, although he expected to attend.

As Mr. Staats stated, our committee has worked hard for three years on this matter, and this last year we have consulted freely with members of your committee. We trust that this report will receive the endorsement of your association.

President Beggs:— I would like to broaden my commendation of the report of the committee, in view of what has been said by the gentleman who has just spoken. The two committees cooperated in the most satisfactory manner, and I hope that the same feeling will continue between the two associations in the future, as our interests are mutual.

On motion, duly seconded, the report of the committee was accepted.

President Beggs:—The next order of business is the report of the Committee on Municipal Ownership, which will be presented by the chairman, Mr. C. D. Wyman, of Boston.

Mr. Wyman:—Mr. President, it is but fair to the committe to make a word of explanation as precedent to the reading of this report. Its members, individually, are intensely interested, as undoubtedly every one is who is controlling or is interested in any of our traction or public utilities companies, in this subject, but each one of the committee has been, as is usual with men holding the positions they do, exceedingly busy during the past year. The committee is constituted of representatives of companies that are very widely scattered. We have been unable, therefore, to meet as we would have liked, and we are to present this morning a report that has not had, perhaps, all the consideration that the committee would have liked to give it, in concert. We have had to do a great deal of work by correspondence.

## REPORT OF THE COMMITTEE ON MUNICIPAL OWNERSHIP.

*To the American Street & Interurban Railway Association:*

Gentlemen.—In August last your committee in a circular letter to the members of the association asked as to the status of the municipal ownership movement in their respective localities. Among other questions to which replies were solicited were the following:

> "What if any agitation or movement has arisen or been in progress during the past year for the extension of municipal public utilities?
>
> "Has there been any movement looking toward the municipalization of your company's business or any part thereof?
>
> "If any such agitation has arisen, please state its cause or causes.
>
> "What seems to be the present status of public opinion in your vicinity touching municipal ownership of public utilities such as street railway and lighting companies?"

To our inquiries one hundred and thirty-two (132) replies were received, of which

55 represented city lines alone.
15 represented interurban lines alone.
62 represented both city and interurban lines.

The number of states represented by replies were thirty-seven (37) — states and territories — and four (4) Canadian provinces. The number of cities covered by these replies, of over 50,000 population, were seventy-three (73), and of those under 50,000 population three hundred and thirty-two (332). The number of municipally owned utilities in cities represented by the replies were as follows:

(1) Street railway systems — 2, one of which was in Canada.
(2) Electric lighting plants — 29.
(3) Gas plants — 4.
(4) Water works — 69.

The answer to the question as to whether there had been any agitation regarding the municipal ownership of street railway lines in the field covered by our membership during the past year, elicits an almost universal negative. We quote a few of the answers returned. The manager of a line operating in one of the largest cities represented in our membership states:

> "In answer to No. 7 as to the present status of public opinion, I may say that the public mind of ———— on the question of municipal ownership has had a very serious set-back, as was demonstrated pretty conclusively by the mayoralty election last spring, when the question of municipal ownership was the dominant issue. It should be stated in this connection that the result came principally from the non-partisan effort of a large number of the better class of citizens to educate the public, and their very thorough efforts were effectual in disabusing their minds of the many glittering fallacies that demagogues, yellow journals and mistaken zealots had built up in their fancy. It occurs to me that the average voter is thoroughly convinced of the rottenness of municipal politics in this country especially, and it is easy to convert him to the fact that graft and perpetuity in office would be the result of municipal ownership."

From a western city the manager writes:

> "Conservative and substantial citizens do not favor further municipalization."

The president of a large company in a southern state says:

> "Much less said now in regard to it than there was a year or two since. The public seems to have lost interest in the subject."

Still another manager reports:

> "Less favorable to lighting than a year ago, and not considering railroads at all."

From central New York the word is sent that the business men of that locality are adverse to the experiment, and from a growing city in the far north a manager of a combined company writes:

> "Decidedly against municipal ownership. Three newspapers adverse to it and also the best business people."

A company in Ohio reports:

> "Authorities are not inclined to municipal ownership; they had a sad experience with the gas plant."

Another company in the same state replies:

> "The public do not want it."

From the far south word is sent that public sentiment is against municipal ownership and a Virginia company reports that the scheme is not looked upon with favor by the more intelligent citizens of the city. Two companies report that there has been some talk about it, and give as reasons therefor the desire for political preferment on the part of some politicians, but qualify the statement by saying that the taxpayers are taking no active steps in support of the movement. One company admits that by reason of poor service which it has been obliged to give there has been some newspaper-talk about the city taking over the railroad lines, and another one speaks of the municipal ownership scheme being used as a threat to obtain certain reductions in fare.

The condition as revealed in the answers with reference to lighting, gas and water works is not quite so favorable, although even with reference to such public utilities, a number of the replies are to the effect that, with existing municipal plants in their cities, the people are becoming disgusted with the operation and the service they afford, and to that extent are being turned against further extension of the municipal ownership scheme.

From a careful reading of these replies, which have been placed by the committee on file with the secretary of the association, we feel safe in making the assertion that municipal socialism as affecting street or interurban railway properties in the sense of the taking over by municipalities of the ownership and operation of such properties, has, as a social doctrine and as a political text, quite considerably decreased in force during the past year. This decadence of the municipal ownership idea may be ascribed to several causes. A year ago the propaganda seemed to be the tide of a great movement which on account of its utility as a political doctrine and its popularity with the masses because of its promises of reduced cost of service and an extension of opportunities for labor, was sweeping on largely unopposed, to the ultimate confiscation of our properties. The glories of its conquests abroad had been for some years rehearsed and the blessings which it would introduce here in this country proclaimed from political platforms and through socialistic publications. But during the last twelve months the people at home and abroad have given to the subject a careful and critical examination of its principles and an analytic study of the facts as developed here and abroad through the trial of the scheme, with the consequence that the weaknesses and the fallacies of the proposition as a social economic theory, and especially the dangers of attempting to introduce to any great extent the practice it advocates in municipalities with the political complexion of American cities, have been shown and what might be termed at least the radical and bald theory of municipal ownership and operation by the people of a municipality of such utilities as those of transportation and to some extent of light, has been marked doubtful and is no longer in a general way being urged.

We believe that the campaign of education which has been in progress during the past year against the theory and principles of municipal ownership, a campaign to which doubtless the members of this association have contributed in public and in private, has shorn the idea of much of its strength and to that extent has weakened its force both as a political and a social enemy. This change of sentiment finds its illustration in the result of the elections in London last March and Chicago in April of this year, both of which contests turned on the questions of municipal trading and municipal ownership, and which, as precedent to the vote, involved a very complete collation of statistics touching the practical result of municipally owned utilities, and as well a great deal of illuminating academic discussion as to the principles and effects of the doctrine. At the London election out of 118 candidates 84 were unconditionally opposed to municipal trading and the candidates in general in their addresses absolutely condemned competition with private enterprises. In Chicago also the issue was practically the same, the line of separation being clearly drawn between those who believed and those who did not believe in the wisdom of placing in the hands of the municipality the transportation business of that city. Thus we think we are safe in the conclusion that municipalization, involving the ownership of a public utility property and its operation by a municipality, has during the last year received a very considerable set-back, and it is pleasing to feel that in the long run the pendulum of justice and fairness, which may, at times of frenzied reform, seem to swing to the extreme point of danger will, after a while, return to the normal and safe position.

It must not be concluded, however, that the dangers to our corporate life are at present so greatly lessened as to be unworthy of our constant care and effort. In the stead of the socialistic theory of municipal ownership there has of late arisen the doctrine of public regulation, which has sprung into such popularity as to have become the favorite measure of legislation in almost every state in the union during the past twelve months. Perhaps we are trespassing upon the preserves of our co-committee — that of public relations — in adverting to this matter, but as it is so intimately related and apparently is to a large extent the outgrowth of the movement for municipal or state ownership of public utilities, we may be forgiven for devoting a page or two to its consideration.

The past year bears many resemblances to the period of the granger agitation. Railroad legislation in the states has been, however, far more widespread. Not only in the central and far West, but in the supposedly more conservative Atlantic seaboard states, a large part of legislative effort has been devoted to passing railroad laws. To be sure, these have referred to the steam companies, but the agitation which has given rise to them has also borne fruit in the passage of certain legislative bills which have included public utility corporations such as trolley, gas, electric light and telephone companies. It has been caculated that the number of such laws affecting railroads passed within the last year is about 300. Ten state legislatures alone at their recent session passed 177 different laws with reference to the control of steam railroad corporations and dealing with almost every department and innumerable details of railroad operation and management, from the reduction of passenger fares to dusting of passenger cars, from establishing railroad commissions more powerful than any ever before created to requiring railroads to run only 8-wheel cabooses. This legislative activity, as is usual in matters of this sort, is largely based upon the ambition of politicians to be known as reformers and to foist themselves into the public notice.

Public utility corporations, therefore, are just now passing through a crisis in their history, the result of which is difficult to predict. The socialistic and political organization through which perhaps more than from any other source the municipalization of street railway companies was preached and to some extent promoted a year ago has, it is true, during the past year, shown less strength and declined to a marked degree but on the other hand, as we have mentioned above, socialistic legislation instigated and promoted by both political parties, has been prevalent, both in congress and in state legislatures to a degree exceeding that of any other period in the country's history. When corporate interests were obliged to face what seemed to be an un-American doctrine, radical in its tendencies and quite opposed to the character of our institutions, the socialism which unaffiliated with other political organizations demanded that all public utilities of every name and nature be turned over to the general government and the state or municipality, the fight was largely in the open and to that extent lacked some of the elements of danger which are present in the more covert and at the same time more generally popular movement which has of late been instituted by both of the democratic and republican organizations for the publicly proclaimed purpose of controlling the corporations for the people, but which it seems to us in many instances, if the provisions embodied in various bills are to be literally carried out, would mean, practically, confiscation. The socialists in this country find their work being done for them, and the rather anomalous spectacle is presented of the decline of a party whose avowed doctrines and policies are at the same time being supported. The condition is one which represents a drift that may become mischievous and dangerous unless we are fully alive to the forces which animate and vitalize it and are willing to meet it fairly and patriotically. Unless we are greatly mistaken, invective and stubborn opposition to the principle of regulation by commission or in some other way will not turn the tide which is setting in favor of that sort of control. That corporate offences have been committed in the haste for extension and for the occupancy of alluring fields which this country has presented, is a fact not to be controverted, and we respectfully submit that it is possible that some proper form of regulation, which shall, on the one hand, prevent ruinous competition to what are natural monopolies and, on the other, assure to investors the proper handling of their funds, would be helpful to all of our interests. We must not deceive ourselves into believing that the spirit of socialism in this country has suffered such a decided reverse that it is entirely relegated to the rear. It is true its army is clad in a somewhat different uniform than formerly and marches under banners with new devices, but unless it is met with the same sort of intelligent study and a willingness to fairly discuss the questions such as has characterized our municipal ownership campaign during the past year, we shall fall short, we fear, of properly safeguarding our interests.

In an excellent report upon this subject, made to the National Electric Light Association at its recent convention by the committee on municipal ownership, and reporting of course on municipal lighting utilities, only, it was stated: "Municipal ownership is not discredited, it is merely in abeyance. It would be a serious error to assume that the present movement of public sentiment toward public regulation signifies that municipal ownership is now or is soon going to be consigned to the limbo of discredited theories along with such past crazes as free coinage of silver at a ratio of sixteen to one. If public regulation shall fail to establish a good understanding between the corporations operating public utilities and the customers of those corporations, we shall inevitably have a revival of the cry for municipal or state ownership."

At the risk of repetition your committee wishes to emphasize its feeling that while municipal ownership as a socialistic scheme has been greatly weakened, it reappears in many of its essential features in some of the schemes which have been legislated upon for what is popularly known as "Public Regulation," and it is our business to meet it on the open platform of discussion with the idea of accepting that which it presents which is fair and just, and to the elimination from it of such elements as are unjust and confiscatory.

Respectfully submitted,
C. D. WYMAN, *Chairman,*
JOHN A. BEELER,
H. M. SLOAN,
J. J. STANLEY,
*Committee on Municipal Ownership.*

On motion, duly seconded, the report of the Committee on Municipal Ownership was approved.

President Beggs:—The next order of business is the report of the Committee on Public Relations. Prior to the presentation of this report, I desire, with your permission to extend the privileges of the floor to Mr. A. T. Bell, President of the Atlantic City Hotel Men's Association, who will make some remarks upon the subject matter that is set forth in the printed circular which you have before you, making the suggestion that Atlantic City should be selected as our permanent place of meeting for a period of five years. The Hotel Men's Association has shown so much energy and interest in making provision for our convention, that I know you will be very glad to hear from Mr. Bell.

Mr. Bell:—Mr. President and Gentlemen, I wish to thank you very much for the opportunity of speaking to you a few minutes in reference to this proposition that we have brought before you, and which has also been presented to your allied Manufacturers' Association. Our city as you have seen, is a city of hotels. Our business, our pleasure, our delight and our profit are from the entertainment of the millions of people who come here every year. Within the last few years, since the organization of our Hotel Men's Association, which is now in its third year, we have made especial effort to provide such facilities as would induce such gatherings as yours to come here to hold their meetings. We found, in your case, that we had, first, the transportation facilities which would bring you here comfortably and conveniently from all the large centers of population, and, second, that we had the hotels to place at your disposal, with private bath rooms and plenty of first class accommodations, but that we were lacking in what might be called an ideal place for exhibits. As a makeshift, however, we have arranged to have your exhibits on this Steel Pier, and with the kind assistance of the United States weather department, we have been able to make good. I do not, however, hesitate to say, what must be evident to any one who has given the matter consideration, that in the event of a storm our pier would not have been the ideal place. Had it rained our curtains, which are drop curtains rolled up above the signs, would all have been spread out at an angle, and thus we would have protected the passageways as best we could. Nevertheless, it would not have been comfortable, and we realize that fact. In order to overcome these difficulties, and to provide some other facilities that are necessary, to make an ideal exhibition hall, we have interested the owners of the next large pier below, what is known as Young's Ocean Pier, in this matter. These gentlemen having reached the point at which they are about to improve their pier property, by the expenditure of a considerable amount of money, have at our solicitation and representation of the feasibility of it, made a proposition which involves the building of what we consider an ideal permanent exhibit hall. The proposed building is long and narrow with two aisles, with spaces on each side of the aisles (double spaces in the centre), a building which would be in all perhaps two-thirds of a mile long, at the end of which would be meeting rooms for your associations; which would have in it space for the storage of crates and boxes and paraphernalia that come with the exhibits; and which in addition to these more permanent facilities would also have live steam at high pressure, in many booths; compressed air in a still larger number of booths, electric feeder wires at all the different commercial voltages, and telephone wires in every booth, and in a general way would have everything that is usually so expensive and so troublesome to get. In addition, we would propose to connect the pier with the steam railroads so that trains of exhibits could be brought right on and the cars run right through these aisles on the tracks, the rails of which would be depressed and could be covered after the exhibits were in place; and a large traveling crane passing over the centre would take the heaviest exhibit right out of a car and put it in position. In other words, so far as the handling of exhibits and large machinery is concerned, it would be equipped like a large, first class machine shop. On each side of the building there would be what might be called a long porch, similar to the passageways here, but which would be about 25 feet wide, and on which there would be a set of tracks, on each side, 3,400 feet long, or the length of the building, approximately, and on those tracks the track exhibits could be placed, so that you would have not only the manufacturing exhibit, but also the track exhibit, right there together. In addition to that, on this ocean pier, we would not be hampered by what are known here as the restrictions of easement deed. Suffice it to say in reference to it, that in order that we might have the ocean side of our broadwalk free and clar, all the property owners signed covenants granting to the city the right to restrict against the putting of buildings outside of the pier, and against the sale of commodities outside of the pier, and against a number of things, among which is this, that they are not permitted to restrict the public from coming in. On the Ocean Pier, however, which was built before the signing of these deeds and the forming of these covenants, these restrictions do not lie, which fact has been determined by carrying the matter through the highest courts. It would therefore be possible, if it were so desired, to exclude the public entirely from this exhibit structure during the time of your convention, which is a matter that some of your exhibitors think very important. The idea, further, is to manage this exhibit hall on something like what is called the "American Plan" of a hotel. If you go to any of our large houses and engage a room, you are shown to your room and find not only your room there, but a carpet, beds, mattresses, bureau, a piece of soap and everything that you need. Go to the dining room, and you find the meals ready for you. In the case of an exhibitor bringing his exhibit to this pier, or to most exhibit places, as soon as he engages his space he has to go out and buy everything that is essential. All that he has is an opportunity. Our idea is to provide all these essentials and include them in one cost. In other words, the first cost would be the last essential cost. It is not intended, however, to restrict individual exhibitors from using their own taste in some individual decoration, and of course they must provide their own exhibits and make them as attractive as they can.

Now, this corporation has in mind the expenditure for the purpose of this hall of a sum approximating $1,500,000, and should it be found on going into the matter later on that the sum necessary would be $2,000,000, that sum will be forth-coming provided the financial plan, which would have to be considered more in detail by the individual exhibitors, is agreeable to them. The question that comes up to your association, is the question whether in a broad general way it would be advisable for you to determine upon Atlantic City as a meeting place for five years, which is the term of years that the pier people feel they should be assured as a starter for the enterprise. There are, of course some large questions in reference to that which you would have to determine, and they are questions upon which I am not in a position to speak to you, or to advise you or to try to influence you. They are questions that you must answer for yourselves. I will, however, say this — that I feel that the consideration of this proposition must be taken up from three points of view. First, there is your own point of view as to whether the erection of such a building is of so great advantage to you that you should determine to come here for five years; second, your Manufacturers' Association must determine in a general way that these facilities proposed are ideal and satisfactory; and then, after those two things have been determined favorably, we must go to the individual exhibitor and ask him whether he sees in it a good business proposition. Now, gentlemen, we will be particularly pleased and gratified, if you will take some action at this time. The financial interests connected with this pier are determined to make an improvement. They must make it in the immediate future. If action is taken now, favorable to this enterprise, they will go ahead along these lines, and if the action taken is unfavorable, or if action is postponed, then they feel that they must go ahead along other lines. A prompt consideration of the matter, and some action taken on the part of your association either favoring it, or placing the authority in the hands of a committee, giving it full power to take definite action later, would be entirely acceptable.

I thank you very much, gentlemen, for your kindness in listening to me, and I wish to express our great pleasure at having had you with us, and for the fine convention which you have brought here, and the representative men that have come here from all parts of the country. We of course are willing to and do receive the amounts of our bills, but we count it as a still greater advantage to us to have had present in our city men of standing, men of importance, who will go back and spread about in their own localities the good name which we are proud to have our city bear.

PRESIDENT BEGGS:— Gentlemen, without attempting to determine what the association will do or should do, my judgment is that it is not prepared to-day to take definite action upon the location of its conventions for the next five years. Therefore it would seem to me that it would be better to refer this entire matter to the incoming executive committee, giving it full power to go ahead in the premises, so that if this is found to be desirable, the committee could act upon the suggestions made by Mr. Bell, without postponing the matter for another twelve months. The executive committee will undoubtedly act in entire harmony with the Manufacturers' Association. Many of us would be perfectly satisfied to come to Atlantic City every year, but that question must be decided for the best interests of the association, but when the executive committee considers the matter from all standpoints it may come to an entirely different conclusion. I should be very glad to hear from the members here.

MR. CLASSEN:— Mr. President, I come from a considerable distance, some 3,000 miles from here, and I would like to have the conventions further toward the center of the United States. I have been thinking they ought to be at St. Louis, Cleveland, or some such point, but there is no question that the executive committee can take the responsibility, and I think it is eminently fitting that this matter should be left entirely to them.

(On motion, duly seconded, the question under discussion was referred to the executive committee with power to act.)

(Vice President Shaw in the chair.)

VICE PRESIDENT SHAW:— The next business will be the report of the Committee on "Heavy Electric Traction," Mr. Calvert Townley, of New Haven, chairman.

## REPORT OF THE COMMITTEE ON HEAVY ELECTRIC TRACTION.

*To the American Street and Interurban Railway Association:*

GENTLEMEN: — The Committee on Heavy Electric Traction respectfully reports as follows:

The scope of you committee's work as suggested in the committee's own report of last year, included mainly, the consideration of such questions pertaining to heavy electric traction, as might from time to time be referred to it by the association. Fortunately, such references have not seemed necessary to your officers, during the past year, and therefore your committee is not called upon to report its consequent findings.

The progress of electrification has been considerable, and the service required from electrified lines widely varied. Owing to this latter fact, and to the rapidly developing state of the art, it is as yet, rather early to attempt to establish new standards, and your committee is not prepared to recommend such.

The more important electric railroad projects begun or materially advanced during the past year have all been bulletined, and many of them described in the technical press. A review of them would be out of place here, but it may be of interest to summarize these in a brief list which is therefore below appended.

### CONTINUOUS CURRENT 500 TO 600 VOLT INSTALLATIONS.

*New York Central & Hudson River Railroad, New York, N. Y.:*

This noteworthy installation which has been in progress for some years, and which comprises thirty-five 100-ton locomotives, and 131 multiple unit cars, has been practically completed and is in successful operation.

*Detroit River Tunnel Co., Detroit, Mich.:*

Six 100-ton locomotives.

*United Railways Co., Portland, Oregon:*

One 35-ton locomotive.

*Boston Elevated Railway Co., Boston, Mass.:*

This company, which has operated heavy elevated service for a number of years, has under construction 308 160-h.p. motors for use as double equipments.

*Metropolitan West Side Elevated Railway Co., Chicago, Ill.:*

Two hundred and twenty-eight 160-h.p. motors have been added to the previous equipment of this company's motor power for use with multiple unit control as double equipments.

*Philadelphia & Western Railroad Co., Philadelphia, Pa.:*

One hundred cars, each equipped with four 125-h.p. motors.

*Brooklyn Rapid Transit Co., Brooklyn, N. Y.:*
This company has added to its rolling stock 100 elevated cars, each equipped with 200-h.p. motors operated with multiple unit control.

*West Jersey & Seashore Railroad (Pennsylvania Railroad), Camden, N. J.:*
Eighty cars, each equipped with two 200-h.p. motors.

*Philadelphia Rapid Transit Co., Philadelphia, Pa.:*
This company has added to its equipment 170 125-h.p. motors for use in two motor equipments.

*The Hudson Companies, New York, N. Y.:*
Fifty cars, each equipped with two 170-h.p. motors.

*Interborough Rapid Transit Co., New York, N. Y.:*
Subway Division — 80 200-h.p. motors, with control equipment.
Manhattan Division — 182 125-h.p. motors, with control equipment.

*Buffalo, Lockport & Rochester Railway Co., Rochester, N. Y.:*
Nineteen cars, equipped with four 75-h.p. motors each.

*Texas Traction Co., Dallas, Tex.:*
Fifteen cars each equipped with four 75-h.p. motors.

*West Shore Railroad Co. (Oneida Ry. Co.), Utica, N. Y.:*
Fifteen cars, each equipped with four 75-h.p. motors.

*Pittsburgh, Harmony, Butler & Newcastle Railway Co.:*
Twelve cars, each equipped with four 75-h.p. motors. This equipment is noteworthy as contemplating the use of 1,200 volts on the trolley, two 600-volt motors being connected in series.

*Buffalo & Lake Erie Traction Co., Buffalo, N. Y.:*
Eight cars, each equipped with four 100-h.p. motors.

### SINGLE PHASE ALTERNATING CURRENT INSTALLATION.

*New York, New Haven & Hartford Railroad Co., New York, N. Y.:*
This installation, which has been in progress for the past two years, has been practically completed and is in successful operation. It comprises 35 90-ton locomotives, operating both from 11,000-volt single phase trolley and a 650-volt continuous current supplied from the third rail.

*Spokane & Inland Empire Railroad Co., Spokane, Washington:*

ihis installation comprises fourteen locomotives, six equipped each with four 100-h.p. motors and eight equipped each with four 175-h.p. motors; also twenty-one passenger cars each equipped with four 100-h.p. motors. This road is operating partly from 6,600-volt trolley and partly from a ontinuous current. Length of track, 146 miles.

*Sarnia Tunnel:*

Five 62-ton locomotives; trolley voltage, 3,300 volts.

*The Illinois Traction System, Springfield, Ill.:*

One 50-ton locomotive and eleven cars, each equipped with four 75-h.p. motors; trolley voltage, 3,300.

*Erie Railroad, Northern New York:*

Six cars, each equipped with four 100-h.p. motors, trolley voltage 11,000. Length of track, 34 miles.

*Washington, Baltimore & Annapolis Railway Co., Baltimore, Md.:*

This equipment comprises twenty-one cars, each equipped with four 125-h.p. motors; also four cars, each equipped with two 125-h.p. motors; trolley voltage, 6,600.

*Richmond & Chesapeake Bay Railway Co., Richmond, Va.:*

Four cars, each equipped with four 125-h.p. motors; trolley voltage, 6,600.

## POLYPHASE INSTALLATIONS.

*Great Northern Railroad, Cascade Tunnel, Washington:*

This equipment will comprise four locomotives, each of 100 tons, to be operated on a 3,000-volt, three-phase alternating current. This installation will doubtless be watched with great interest and will give an opportunity of demonstrating the fact regarding the advantages for and objections to polyphase currents for heavy railroad service.

## CONTINUOUS CURRENT 1,200-VOLT INSTALLATION.

*Southern Pacific Co., Oakland, Cal.:*

This equipment will comprise forty-four cars, each to be equipped with four 125-h.p. motors, to be operated continuously two in series on 1,200 volts; there will be forty trail-car equipments.

*Indianapolis & Louisville Traction Co., Louisville, Ky.:*

Ten cars each, to be equipped with four 75-h.p. motors connected two in series for 1,200 volt operation.

Much interest has been attracted to the investigations of the Pennsylvania Railroad, which is preparing to equip its New York City terminal and the tunnels connecting Manhattan Island with New Jersey and with Long Island by electricity. For the purposes of demonstrating the various possibilities open, it has been arranged to test both large continuous current and large alternating current locomotives, that comprising the greatest novelty being a 152-ton 15-cycle, single-phase alternating current locomotive for operation from 11,000-volt trolley.

Respectfully submitted,
CALVERT TOWNLEY, *Chairman,*
E. B. KATTE,
L. B. STILLWELL,
*Committee on Heavy Electric Traction.*

On motion duly seconded, the report was approved.

VICE PRESIDENT SHAW:— The next order of business will be the report of the Committee on Compensation for Carrying United States Mail, and it will be presented by Gen. G. H. Harries, of Washington, D. C., who is a member of the Committee.

## REPORT OF THE COMMITTEE ON COMPENSATION FOR CARRYING UNITED STATES MAIL.

*To the American Street and Interurban Railway Association:*

GENTLEMEN: — As shown in its report submitted at the 1906 convention, your committee had succeeded at that time in procuring legislation to increase the maximum compensation for carrying closed pouch mail from three cents per car-mile to four cents per car-mile in certain cases under certain conditions.

At the same time Congress placed a very serious restriction in the law by providing that on electric railroads, outside of cities, where the roads exceed a distance of twenty miles, the compensation received by such roads should not exceed the rates paid to the steam roads. This is an unfair discrimination and will cause many railway managements more or less distress because the compensation paid must necessarily be less than the actual cost of rendering the service. The difference between steam service and electric service is manifest to all.

During the past year your committee has had several conferences in Washington with the postal authorities in charge of these matters and has also appeared before Hon. Jesse Overstreet, Chairman of the House Committee on Post Offices and Post Roads. The two principal conferences were held, one on December 15, 1906, and the other on January 5, 1907.

Your committee asked that the maximum for closed pouch service be increased to six cents per car-mile, leaving three cents per car-mile as a minimum, as in many cases the latter rate is a fair compensation. The committee recommended that the increased compensation be based, at the discretion of the department, upon the number of stops, weight of mail and general character and nature of the service.

Your committee further asked for increased compensation for cars used exclusively for mail service on electric lines, to a rate not less than twenty-five cents as a minimum per car-mile, and for cars over twenty feet in length, one additional cent per car-mile for each additional linear foot. One of the arguments used in this connection is that a considerable distance must be traveled to and from the post office and another is that in many cases it is costing the company twenty-three cents a car-mile to operate cars of this character.

The third request of your committee was that the twenty-mile limitation be extended to fifty miles, as in many cases the law limiting the length of roads to twenty miles has worked out to great disadvantage to the interurban roads.

Although your representatives were most courteously received, and while the requsts of your committee were given careful consideration, both by the postal department and by the chairman of the House Committee on Post Offices and Post Roads, it was not found possible to obtain any definite results during the past year.

This was for the reason that Congress had a short session last year, into which a vast amount of business had to be crowded and for the further and probably more important reason that two very important matters of the postal service were to be considered at that session of Congress. These were the revisions of the laws relating to second-class matter and the consideration of the question of increasing the compensation paid to postal employes.

Your committee respectfully recommends that another attempt be made, early in the coming session, to obtain legislative action by Congress favorable to the three requests enumerated above.

Respectfully submitted,

G. T. Rogers, *Chairman.*
Capt. Robert McCulloch,
Gen. G. H. Harries,
P. F. Sullivan,
*Committee on Compensation for Carrying United States Mail.*

On motion, duly seconded, the report was approved.

Vice President Shaw:—We will now take up the paper entitled "The Use of The 'Tee' Rail in Cities," which will be presented by Mr. C. Gordon Reel, of Kingston, New York.

Mr. Reel:—Before reading my paper I wish to mention, gentlemen, that the Twin City Rapid Transit Company, of Minneapolis and St. Paul, which has such a splendid exhibit here as well as The Milwaukee Electric Railway and Light Company and the Montreal Street Railway Company are all using the "Tee" rail exclusively.

It was said yesterday that this question of "Tee" rails is essentially an engineering question. While it is true that it is an engineering question, at the same time it is a question that must be determined ultimately more by the general officers rather than by the engineering department, because the engineers all know the advantages of "Tee" rail construction, whereas the trouble is usually, that the municipality will not allow the use of the "Tee" rail, and this prejudice must be overcome by the general officers of the company.

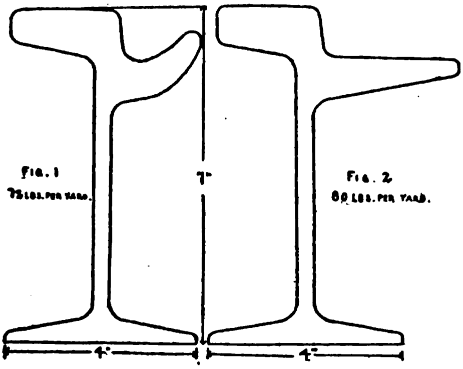
I am under the impression that corrugation is less with "Tee" rails than it is with girder rails, and I would suggest that this feature be given consideration by the committee which is to investigate the subject of rail corrugation. Recent tests seem to conclusively prove that corrugation is not the result of inequalities in the rail itself and that it is the equipment run over the rails which causes the corrugation. In the case of steam roads corrugation amounts to practically nothing, and it may be that it is largely due to improper design of rail sections in the case of electric roads.

## THE USE OF THE "TEE" RAIL IN CITIES.

By C. Gordon Reel, *Vice President,*
Kingston Consolidated Railroad Co., Kingston, N. Y.

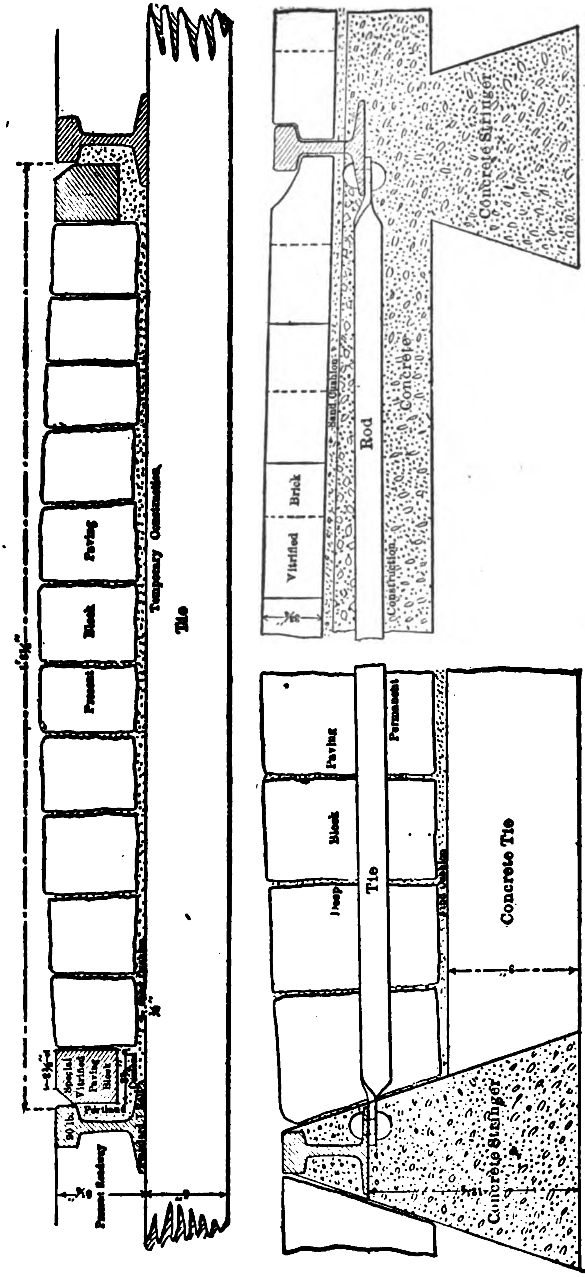
In the horse car days the equipment was so light and speeds so leisurely that the problem of a proper track was easy of solution. It was expected that wagon traffic of all kinds would follow along the car tracks and so city ordinances usually required that the street railroad companies make proper provision for the accommodation of vehicular traffic. With the introduction of electricity, weights and speeds were increased enormously. The trend of development has been steadily to approach nearer and nearer to steam railroad standards. With the increase in weight of equipment and increase of speed the grooved and girder rail sections have demonstrated their inability to carry the car traffic without rapid deterioration. The inefficiency of these sections is due not to the light weight so much as to their unscientific design. The vertical web of the rail is usually directly under the flange of the wheel so that the weight of the car is carried on a sort of projecting shelf. This unsymmetrical loading is more than the rails can stand. They pound down rapidly at the joints and can not be held to gage. Our companies were unfortunate enough to build with 7-in. grooved and girder sections shown in Figs. 1 and 2. These rails were structural wrecks at the joints long before they were worn appreciably.

In other cities similar sections have been used which overcame the inherent weakness in design by brute strength so to speak; that is, they are rolled in weights up to 150-lb. per yard, which would seem absurd to steam railroad men, especially in view of the very much heavier rolling stock used by the steam roads. It is self-evident that a proper section should not be inordinately heavy and should carry its load with no tendency to moving sideways, and furthermore, that the track should stand solidly in place without having to strap the rails together every few feet. All "Tee" rails fulfill the first two requirements, but the standard steam railroad sections would seem to serve better than the high "Tee" sections in regard to lateral stability. Just what is gained by using a high "Tee" is hard to understand, still I am willing to concede that, in view of the experience of some of the larger cities which use this rail, there is a chance for an argument between high "Tee" sections and standard "Tee" sections. Personally I would prefer to pay more per ton for standard sections than for high "Tee" sections, although under ruling prices the high "Tees" cost considerably more per ton than standard "Tee" sections.



FIGS. 1 AND 2.— GROOVED AND GIRDER SECTIONS ORIGINALLY USED IN KINGSTON, N. Y.

When it became necessary to renew the tracks in Kingston, I looked over the experience of other companies and concluded that the "Tee" rail was in every way more desirable than the grooved, or girder rail, and proceeded accordingly. To make sure we laid an experimental piece of track using 90-lb. A. S. C. E. standard rail. This gave such good results that we placed an order for several hundred tons in 60-ft. lengths with a view to extending the con-



St. Ry. Journal

FIG. 3.—PROPOSED TRACK CONSTRUCTION WITH 90-LB. A. S. C. E. RAIL IN KINGSTON, N. Y.

struction. After the rails were delivered a bitter opposition was engineered by interests which formerly owned one of our roads and who seem to be sore because we have been successful. It was argued that if, when they built the road, it was necessary to use an iron lip, that unless we used the iron lip, ruts would form along the rails. The only difficulty about this point is that it was not necessary, in the first place, to use any iron lip because experience proves that there is no greater tendency for a rut to form along a "Tee" rail than along the outer edges of a grooved or girder rail. They also used letters from city engineers of New York, Brooklyn and Albany, stating that no "Tee" rails were used in those cities. This argument we easily answered by asking our opponents to produce letters from cities where "Tee" rails *had been used.* The fact that they produced letters from places where they *had not been used* was certainly no evidence against their use. After a lot of misrepresentation and personal abuse in their newspaper we finally got consent from the city to lay "Tee" rails in two rather important streets with the stipulation that if, after the end of a year, the city authorities so desired we would remove them and substitute the old rails. As an instance of the unfairness of the opposition, this proposed trial was fought bitterly. They well knew that if the construction was tried it would make good. Another feature which had to be overcome was a bill introduced in the legislature intended to prohibit the use of the "Tee" rail entirely in the State of New York. Whether or not this bill had any connection with the Kingston opposition or was merely a coincidence I am unable to say. In any event the bill was easily defeated and was never reported from committee.

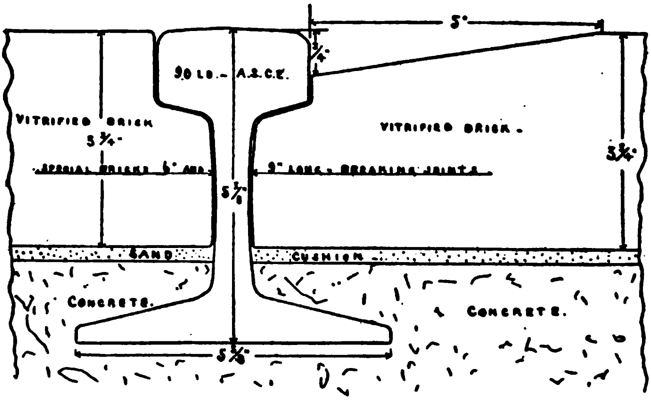


FIG. 4.—LATEST CONSTRUCTION IN KINGSTON, N. Y., SHOWING SPECIAL BRICK OUTSIDE OF RAIL.

Since the installation of this 90-lb. standard construction in the two streets referred to, we have been granted ***permanent permission***

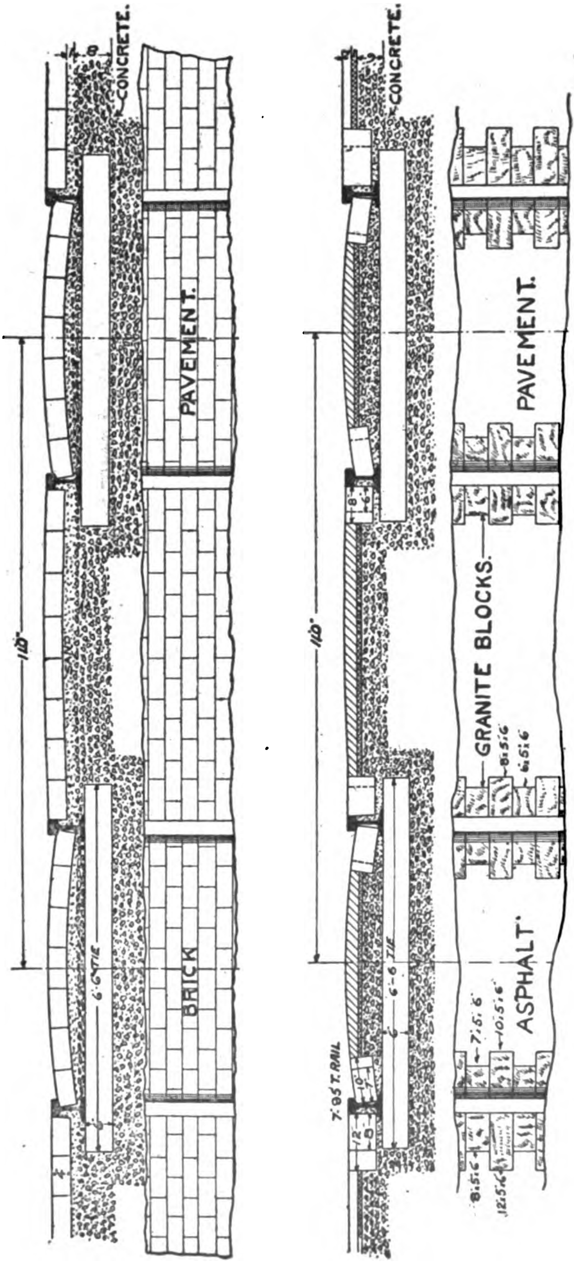


FIG. 5.—STANDARD CONSTRUCTION IN MILWAUKEE, WIS.

*without any restrictions* to use this 90-lb. standard "Tee" rail in Broadway, Main street and Fair street, which are the most important streets in the city. The opposition has simply made itself ridiculous and is now considered a joke.

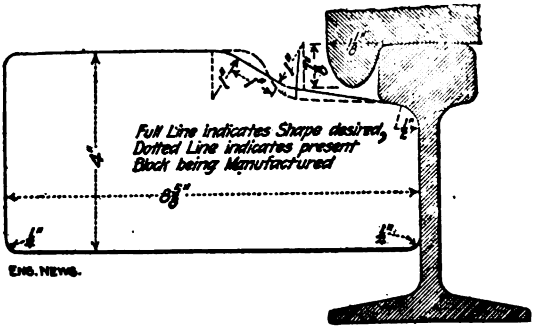

Full Line indicates Shape desired,
Dotted Line indicates present
Block being Manufactured
ENG. NEWS.

FIG. 6.—TYPE OF CONSTRUCTION, FT. WAYNE, IND.

Fig. 3 shows the construction first proposed.

This has been amended as shown in Fig. 4; that is, we are using a special form of brick outside the rail as well as inside. It will be noted that on the inside we will go up on the head of the rail to such a distance as to barely give room enough for our wheel flange.

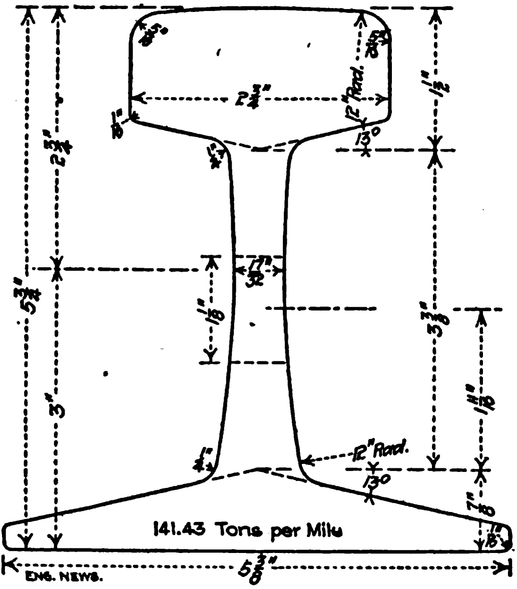


FIG. 7.—OPEN-HEARTH SECTION.

In this way the obstruction in the street will be much less than though the brick projected under the head of the rail and very much less than any form of grooved or girder rail. I might say in passing, however, that it is now standard practice to use only ordinary brick. On the outside the brick is merely laid flush with the rail, and on the inside it is tucked under the head as shown in Fig. 5, which illustrates the construction now standard in the streets of Milwaukee.

The "Nose" brick extensively used heretofore has not been entirely satisfactory. By referring to Fig. 6, which illustrates the type of construction adopted in Fort Wayne, and described in the Engineering News, June 20, 1907, it will be noted that the designer desired a somewhat different form than the market provided. We think that the kind we are having made for Kingston, illustrated in Fig. 4, combines many desirable features. In the event of heavier flanges being used experience teaches that they will cut their own way in the brick and will not crack the pavement.

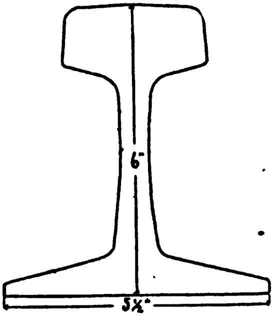


FIG. 8.—THE DUDLEY 100-LB. "TEE" SECTION.

In regard to what standard section to use we have found the 90-lb. A. S. C. E. most satisfactory. It would seem though that the open-hearth section used by the Union Pacific and the Southern Pacific Railroads (Fig. 7) would be very desirable since it has somewhat more height and better proportions generally. If heavier rail than the 90-lb. is used the Dudley 100-lb., section, Fig. 8, would be excellent as would also the section designed by Capt. R. W. Hunt.

By referring to the following publications admirable types of construction will be illustrated.

| | |
|---|---|
| Tacoma, Washington | Street Railway Journal, Sept. 7, 1907. |
| *Kingston, N. Y. | Street Railway Journal, Jan. 26, 1907. |
| Indianapolis, Ind. | Electric Traction Weekly, Feb. 7, 1907. |
| Seattle, Wash. | Electric Railway Review, June 29, 1907. |
| Milwaukee, Wis. | Street Railway Journal, Sept. 7, 1907. |
| Montreal, Canada | Street Railway Journal, Sept. 7, 1907. |

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*(This article includes a list of letters from *city engineers* throughout the country stating that they have adopted "Tee" rails, and explaining why they prefer them to the old grooved and girder types.)

The gist of the whole "Tee" rail matter seems to be that street railway tracks are beginning to be built to serve the companies which build them and the patrons of these companies, rather than every Tom, Dick and Harry of a truckman who stubbornly insists on following the car tracks instead of staying out in the roadway where he belongs. If this driving along the tracks served any economic end it might be tolerated, but it does the truckman no good and interferes with the movement and comfortable transportation of countless thousands of more important people. It would seem incredible if it were not true that any one would argue in favor of having the tracks of a street railroad reserved for the transportation of merchandise at the inconvenience and discomfort of human beings.

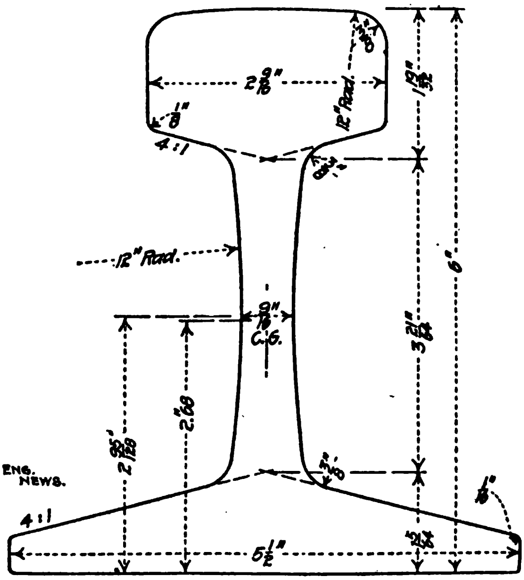

FIG. 9.—THE HUNT "TEE" SECTION.

The horse car, the wagon on the track, slow speed, light equipment, grooved and girder rails bespeak the *past*. The electric car with the wagon in the roadway, high speed, heavy equipment on "Tee" rails belong to the *present*. If any man or body of men, either through ignorance or spite, endeavor to relegate any of you gentlemen back to the past and, benightedly or spitefully, attempt to require you to continue grooved and girder rails in the face of present development, you will combat and overcome this ignorance and prejudice if you have a spark of manhood, and, as "Angels of Light," will fight for and achieve "Tee" rails, thus confounding these benighted spirits of the Dark Ages.

## *Discussion of Mr. Reel's Paper.*

MR. CRAFTS:—I wish to ask Mr. Reel what is the particular object in using 90-lb. rail, over, say, 70-lb. rail?

MR. REEL:—My idea was that I would be putting in something very much more substantial. The standard 90-lb. "Tee" rail is sold to us on a basis of $28 a gross ton, and the 70-lb. high "Tee" rail is sold on a basis of $36 a ton, so you see we get 20 lbs. of good steel for a present by using standard "Tee's."

MR. CRAFTS:—I am referring to the standard A. S. C. E. section.

MR. REEL:—The 70-lb. "Tee" rail is only 4.75-in. high and you will hardly get your paving bricks over the heads of the spikes. You will not have any room for the one-half inch sand cushion which we use. The 100-lb. Hunt section shown in Fig. 9 looks to me like an ideal one for railroads in this part of the country.

MR. CRAFTS:—I have just taken over a road which has two miles of double track equipped with 70-lb. standard section, and that is the trouble which I anticipated. We are going to operate thirty-seven ton cars over this track. In investigating the matter there seems to be but little space for the sand cushion.

MR. COEN:—Our experience on the Lake Shore Electric Railway has been that the 70-lb. "Tee" rail in paved streets is unsatisfactory. The brick will not stay. We have abandoned that construction entirely, except on some streets where there is little service or on which we operate very light cars. With heavy cars the rail is absolutely unsatisfactory. If you use nosed brick, with the nose under the rail, the other end of the brick will turn out.

MR. CRAFTS:—That is the trouble, I imagine. We purchased cars with wheel flanges of the standard M. C. B. dimensions, 1.25-in. each way, and, anticipating something of that kind, we have been obliged to reduce the depth of the flanges.

MR. MITCHEL:—On the Knoxville Railway we have two miles of double track paved with 70-lb. "Tee" rail, but we use a special brick with the corner hollowed off, same fitting under the rail. These brick come in half and whole lengths which are placed alternately. About every seven or eight feet we put an expansion joint of pitch and the rest is cemented. This construction leaves a small groove, sufficiently large for the wheel flanges. It is all cemented together, and when taken up is like a solid mass. We get a 0.5-in. or a 0.75-in. sand cushion. There is no turning up, in the case of our brick, because it is one solid mass across the pavement.

VICE PRESIDENT SHAW:—The next order of business is the paper entitled "Interurban Railway Fares," which will be presented by the author, Mr. Theodore Stebbins, of New York City.

## INTERURBAN RAILWAY FARES.

BY THEODORE STEBBINS,
New York, N. Y.

The subject of interurban fares is one of immediate interest because matters connected with the transportation of persons and property by railroads have been the subject of very active and even violent popular discussion. The state legislatures have been taking blind actions and state executives have been advocating and adopting arbitrary measures with the railroads. Twenty state legislatures have passed restrictive legislation on passenger rates, and fourteen states now limit passenger rates to two cents a mile. In this situation, it is important to understand the position of the interurban railway.

All interurbans are anxious to serve the public and to earn reasonable dividends for stockholders. It is not so clear, however, how rates shall be adjusted to satisfy these ends. It is customary to measure the service and its cost on the basis of *cents per passenger-mile.*

The cost per *car-mile* of operation does not afford a direct measure of the rates that should be charged to passengers. The density of travel has a far greater influence on rates. The road must be built and furnish a service to suit the distribution and density of population and the fares that can be collected follow as a consequence of this environment. The cost per *car-mile* may not vary much between properties quite different in character, but it is the commercial and social habits of the people which determine the quantity and times of traveling as well as the percentage of the car-load (that is, passenger-miles divided by seat-miles) and thus the passenger rates are determined.

### COST OF SERVICE.

The seat-mile cost can be figured as shown for *illustration* in the following table which indicates, also, the effect on such cost of more frequent service:

| Annual cost per mile of track | *A* | *B* | *C* |
|---|---|---|---|
| Headway (minutes) ............. | 60 | 30 | 15 |
| Car-miles (plus extras)........... | 15,000 | 30,000 | 60,000 |
| Cost of operation................. | $1,800 | $3,600 | $7,200 |
| Interest and depreciation......... | 2,700 | 3,600 | 4,500 |
|  | $4,500 | $7,200 | $11,700 |
| Cost per car-mile (cents)......... | 30 | 24 | 20 |
| Car seating capacity............... | 40 | 40 | 40 |
| Car seat-mile cost (cents)........ | 0.75 | 0.6 | 0.5 |

The actual passenger rate per mile must be more than the car-seat cost as a minimum in proportion as the passenger-miles are less than the car-seat miles. If the passenger-load averages 40 per cent. of the seating capacity then, on a sixty-minute headway, the average cost would be 100/40 times 0.75 cents, or 1⅞ cents per mile. This indicates how much rates might be decreased if full loads were constantly carried and why some roads can afford to make mileage rates less than other roads.

The distribution and occupations of the population along the line are the powerful elements affecting the percentage of load. Assume two roads, each fifteen miles long; the first joining two cities of large size with little intermediate population, and the second leaving a city and traversing a succession of villages growing smaller and terminating in a country hamlet. The first road may prosper on one cent per mile and the second starve on two cents even though operating the same number of cars with the same number of passengers to and from the principal terminal. In the first, the loads are carried through; in the second case, two-thirds of the load may be dropped within the first four miles. Assume a third case where a succession of towns of equal importance are traversed. The cars may load and unload several times in the course of the trip and this makes for an intermediate policy on rates.

### Density of Travel.

To give some idea of the variation in density of travel on electric railways, the following figures are given.

| *Territory.* | *Passenger per mile.* | *Average fare.* | *Receipts per mile.* |
|---|---|---|---|
| United Kingdom .............. | 939,658 | 2.26 cents | $21,240 |
| United States ................. | 333,862 | 3.76 " | 12,553 |
| Indiana . . . . ..................... | 133,000 | 5.6 " | 7,500 |

The above figures for the United States and Indiana include all electric railways; that is, both city and interurban. The density of travel on the Ohio interurbans is indicated in the following table, grouping them together according to principal terminal:

| *Principal terminal.* | *Its population.* | *Receipts per mile.* |
|---|---|---|
| Cleveland | 500,000 | $5,045 |
| Columbus | 200,000 | 3,829 |
| Toledo | 225,000 | 3,257 |
| Dayton | 90,000 | 3,137 |
| Miscellaneous | ........ | 3,542 |

Twenty-eight interurbans in this same section are classified in annual receipts as follows:

| | | | |
|---|---|---|---|
| 0 to $2,000 | 4 | 8 | 19 |
| $2,000 to 2,500 | 4 | | |
| 2,500 to 3,000 | 7 | 11 | |
| 3,000 to 3,500 | 4 | | |
| 3,500 to 4,000 | 1 | 4 | 9 |
| 4,000 to 4,500 | 3 | | |
| 4,500 to 5,000 | 1 | 5 | |
| 5,000 up | 4 | | |
| | 28 | | |

As indicating the variation in car-miles per mile of road, it may be stated that the elevated roads in New York operate 1,635,000 miles per mile of road, as against 15,000, or less, for the ordinary interurban road in the Middle West, while the expenses per car-mile on the elevated are nine cents per mile, as compared with about fourteen cents for the Middle West interurban.

The expenses per car-mile and per seat-mile for a known service are capable of calculation with mathematical precision, but the density of the traffic can only be learned by experience and this experience indicates how much the rates charged must be increased beyond the basic seat-mile cost.

## WESTERN INTERURBANS.

For the average conditions prevailing throughout the Middle West and other sections of medium density of population, a large amount of testimony is available to show that the basic single trip rate should be upwards of two cents per mile. If less is charged, not enough additional travel is secured to increase the gross receipts. If more is charged, travel is curtailed and the gross is reduced. In stating this it must be understood that mileage, commuter and other lower rates are granted and maintained at proper relation to the single trip rate.

The widest consensus of opinion on the subject is found in a resolution passed by the Ohio Interurban Railway Association on May 25,

1905. This association represented about two thousand miles of interurban roads and the matter was given earnest consideration in private discussion between the members and in the open meeting. The resolution reads as follows:

'WHEREAS, A demand for improved service on interurban roads has very largely increased the operating expenses of such roads, and many roads have met this demand; and, WHEREAS, in order to obtain their share of the business many other roads contemplate improving their service in like manner; and, WHEREAS, the prevailing low rate of fare on most interurban roads will not permit of such improvement in service, therefore, be it RESOLVED, that the Ohio Interurban Railway Association recommend a uniform base rate of two cents per mile, and a minimum charge of 10 cents."

Mr. A. H. Royce, secretary and treasurer of the Canadian Street Railway Association, writes:

"Since the reduction to two cents a mile (by legislative act) the companies have done away with all commutation tickets and charge a flat rate of two cents a mile. We find that it is impossible to operate a road properly and keep up the rolling stock and equipment even at less rate.

In the other provinces of Canada, the rates of fare are regulated by agreements with the municipalities through which they operate. There is no legislation affecting these rates, and as a rule the charge is three cents a mile."

Mr. J. McM. Smith, general manager of the Southern Michigan Railway Co., writes:

"We started out a year or two ago on the rate basis of one and one-half and one and three-quarters cents per mile, but we found this to be entirely too low, and accordingly we made a uniform raise. It is my belief, based on long years of experience in this business, that a road must be exceptionally well located if it can be made profitable on a rate less than two cents per mile."

Mr. S. Hendrie, general manager of the Grand Rapids, Holland & Chicago Railway, writes:

"I am inclined to think that all our interurban passenger fares in Michigan are too low in view of the increase in the wages and in the cost of all materials which enter into the construction and operation of electric roads to-day. In 1894-96 I took franchises for a road on the average of one cent per passenger mile, but new steel then cost $16 per ton, copper 13 cents per pound, number one standard ties, 35 cents each, common labor $1.50 per day, etc. At that time, conductors and motormen were paid 17.5 cents per hour, and other labor in proportion. The same road could not be built to-day for twice its cost, and although the fixed charges are low, the present owners are not satisfied with its net earnings."

Mr. H. H. Polk, president of the Inter-Urban Railway Co. of Des Moines, Iowa, writes:

"The rates generally charged are as follows:

2 cents a mile for single trip tickets.

1.5 cents for round trip tickets, good for one day.

1.25 cents for mileage.

(These mileage books are for any three people, and good until used.)

However, I am of the opinion that our round trip and mileage rates are too low, and we are seriously considering the raising of these rates. With the universal two-cent fare now forced on the steam railroads by state legislatures, I am of the opinion that it will be rather up-hill work for interurbans to exist at the present rates."

Mr. C. N. Wilcoxen, general manager of the Cleveland & Southwestern Traction Co., writes:

"There are but very few roads in this state operating at less than two cents per mile, with the usual reduction for commuters' tickets, etc. The average rate obtained by the Ohio roads is approximately 1.65 cents per mile. To attempt to operate on a 1.25 cents per mile basis would mean bankruptcy to the interurban roads of this state."

Mr. H. A. Nicholl, of the Indiana Union Traction Co., writes:

"Our single trip tickets are 1.5 cents per mile. This is as low a rate as I believe any electric road can carry passengers with a reasonable profit."

### EASTERN INTERURBANS.

From the average conditions prevailing in Massachusetts, New Jersey, some parts of Pennsylvania and other sections with considerable density of population, a large amount of testimony is available to show that the heavier travel, the more frequent trips, the shorter rides, and repeated loading and unloading in a trip, make profitable and advisable no variety of tickets but only a single adult rate.

Mr. M. C. Brush, vice-president of the Newton Street Railway Co., and associated companies writes:

"I find upon careful investigation that on about 50 per cent. of our lines our fares vary from 1 cent per mile to 1.5 cents per mile. On the remaining 50 per cent. it varies from 0.4 to 0.9 of a cent per mile. The average New England street railway manager does not believe that under present operating conditions it is possible to carry a patron more than five or six miles for 5 cents. That is, I think you will find that the average New England manager believes that one cent per mile is a fair charge in this territory."

NOTE.—The Massachusetts law requires half rate for school tickets.

Mr. F. L. Fuller, vice-president and general manager of the New York & Queens County Railway Co., writes:

"The rates on Long Island are one cent per mile collected in five cent zones"

Mr. F. W. Bacon, general manager of the New Jersey & Hudson River Railway & Ferry Co., writes:

"I do not think the rates in New Jersey on interurban roads are in excess of 1.25 cents per mile and our average rate is 1.15 cents per mile, but we do not issue commutation tickets or other forms at any cheaper rates and only make 25 per cent. reduction on school tickets."

## CALIFORNIAN INTERURBANS.

The extremes on rates seem to exist in California. Mr. Schindler, of Chico, California, makes most interesting statements. His line, in the Sacramento Valley, has steam railroad conditions, and charges three cents per mile, and his patrons are well satisfied. In the southern part of the state, business is done mostly on round trip tickets at 0.6 of a cent per mile. He states:

"It is a curious fact that in the southern territory where existing rates are already extremely low, there is a strong movement toward a further reduction of rates; while here where the highest rates exist, the public is generally well satisfied."

The above quotations are taken from letters on the subject of Rates addressed to our secretary, Professor Swenson, to whom I am much indebted for this and some statistical information.

Examination shows a clear distinction in conditions and practice between the two and one-cent rates per mile.

The one cent rate applies to conditions approaching those of the city railway, five cent zones, no tickets, a succession of towns, with contiguous population limits.

The two-cent rate applies to cities and towns considerably separated, where passengers may travel, 25, 50, 100 or 200 miles, and this rate applies to occasional travelers on single trip or interline tickets. Tickets are also sold and gradations of adult rates for commuter and school travel are made down to one cent per mile. For interurbans of this character, we will describe the kind of tickets sold.

## KIND OF TICKETS.

1. The single trip ticket (good between specified points for an adult) is the *basis* of maximum charge on each interurban line. Occasionally, a higher rate is charged for fare paid on the cars, but this practice is diminishing, because it entails a greater variety of fares and discriminates against the farm community boarding the cars where ticket offices cannot be maintained, and this farm community is often the most important class of customers for the road. To increase the sale of tickets in order that cash may be taken at the offices and not by conductors, it has been proposed to charge higher cash fares on the cars and give receipts with a redeemable value to any ticket office, the same as some steam railroads do, but this is impracticable for interurban conditions and in one case only to my knowledge has been adopted.

2. The round trip ticket good for an adult, is the most common form of ticket, in fact is sold by some roads where single trip tickets are not sold, and is ordinarily sold at a 10 per cent. reduction over double the single trip rate. In a few cases the reduction is 20 per cent.

3. Interline tickets are those sold by one road for transportation over its own line and one or more connecting lines, usually not more than three. Such a ticket, when sold for a round trip may be nearly a yard long and practically correspond in form and appearance to the familiar steam railroad ticket. The interurbans of the Central West sell large numbers of these tickets and they are essential in competition with the steam railroads.

4. Mileage books, so-called, are sold at 16⅔ per cent. to 33⅓ per cent. reduction from the base rate. If such books are good for a specified number of miles, 500 or 1,000, then the conductor must carry a sheet of mileage distances between points and detach coupons accordingly. The reservation is commonly made that no less than five coupons shall be detached. Since the rates per mile charged on different roads and often on various sections of the same road vary for franchise or other reasons, it has, therefore, been found expedient to issue "Mileage Books" not for a specified number of miles but containing a certain number of *five cent coupons*. This avoids the necessity of conductors carrying mileage cards, permits detaching coupons of a *face* value equal to the single trip ticket; reduces the complexity of accounting and in general is practical where *mileage* coupons are impracticable. Properly these are called *Coupon* Ticket Books and if good on one road "Local;" if good on a group of roads, "Interchangeable;" but we continue to speak of them in common parlance, as "Mileage Books." Such interchangeable books issued by certain members of the Central States Interurban Association contain 240 five-cent coupons, face value $12, sold at a net price of $10. These books are good for use over some thirty-seven railways and their underlying companies, all operating several thousand miles of track. This book is good for one person only, usable within one year and not less than two five-cent coupons are detached for any ride, no matter how short. Each individual company is free to issue, also, mileage books good over its own line under such conditions as it may see fit. In some cases these are good for use without restriction as to name and number of persons and at a slightly lower rate.

5. Commuter books are also sold, good commonly only for either thirty days or a calendar month, and containing forty, fifty or sixty rides, each book limited to one name. Such books are not in as common use now as the writer believes they will be in the future, as they form a means of building up a steady suburban travel, the same as steam roads operate so profitably out of our large cities and without interfering with higher charges for occasional travelers.

6. Book tickets are sold for ten, twenty, thirty, forty, fifty, or one hundred rides, with or without limitation, as to name or family, or

length of use, and on some roads serve the same purpose as commuter books.

7. Excursion tickets are sold by almost all roads for special occasions, usually limited to one day and issued for summer riding to parks, church picnics, political meetings, city shopping, and a great variety of purposes.

8. Half rate tickets are sold for single and round trips of children from five to twelve years of age.

9. Party tickets are sold for a specified number of persons traveling together between specified points within a time limit.

10. Special car-load rates are made for excursions at the lowest rates. The car is permitted to carry a full seated load and usually a limited additional number of standing persons.

Twenty-six interurbans in Ohio, Indiana and Michigan are reported by the Street Railway Journal to sell these kinds:

| *Tickets.* | *No. of Companies.* |
|---|---|
| Single trip | 24 |
| Round trip | 24 |
| Commutation (individual) | 13 |
| Commutation (family) | 11 |
| School tickets | 14 |
| Mileage books | 10 |
| Interchangeable coupons | 15 |
| Sunday | 7 |
| Week-end | 4 |
| Not selling tickets | 2 |

All the above and many more forms of paid transportation are used in the development of the interurban business. The writer, on undertaking the management of an interurban system, found in use tickets of as many as 400 kinds; that is, differing in form and points between which they were usable.

## GRADATION OF RATES.

The gradation of price between these various forms of tickets must follow a consistent sequence in order that each ticket may find its proper use. To illustrate: If the mileage book price is less than the commuter rate there would be no sale for commuter books. The gradation is commonly something like this: Assume the base rate for a single trip ticket is two cents per mile, round trip ticket will be 10 per cent. off, or 1 8-10 cents; the interline single trip ticket will be the sum of the single trip rates of the connecting roads and the interline round trip ticket will likewise be the sum of the round trip rates of the connecting roads, or less if there is a competitive route; the mileage book will be 16⅔ per cent. off or 1⅔ cents per mile net; the commuter book ticket rates will be about 1.25 cents; the school rate will be one cent and the excursion rate and party rate will vary from 0.5 cent to 1.5 cents, according to distance, size of excursion and other conditions. This gives a general idea of the consistent relationship between these various rates, but, of course, there are considerable departures from this practice in individual cases.

The average gradation of rates in cents per mile, in three western states is shown in figures from the Street Railway Journal, May 5, 1905, as follows:

| | Ohio | | Michigan | | Indiana | |
|---|---|---|---|---|---|---|
| | Cents. | No. Cos issuing. | Cents. | No. Cos issuing. | Cents. | No. Cos issuing. |
| Cash fare | 1.84 | 23 | 1.58 | 5 | 1.68 | 8 |
| Single trips | 1.77 | 17 | 1.48 | 4 | 1.68 | 6 |
| Round trip | 1.63 | 20 | 1.34 | 4 | 1.45 | 6 |
| Commuters (family) | 1.45 | 12 | 1.10 | 2 | 1.23 | 3 |
| Commuters (individual) | 1.09 | 17 | 1.00 | 2 | 1.20 | 5 |
| Mileage | 1.37 | 6 | 1.25 | 1 | 1.22 | 2 |
| Interline coupons | 1.48 | 10 | 1.30 | 1 | 1.67 | 1 |
| School | 1.03 | 12 | 0.87 | 2 | 0.94 | 4 |

## THE ESTABLISHMENT OF RATES.

Mr. C. L. S. Tingley, Vice-President of the American Railways Co. of Philadelphia, speaking of Pennsylvania conditions states:

"The whole thing is a matter of ordinance regulation and not a question of scientific rate making."

This is true for many roads elsewhere.

For the short interurban, with the dense traffic, five cent zones and no tickets are clearly indicated.

For the long interurban, experience has clearly indicated the expediency of a mileage basis of charge with tickets and a gradation of rates for different classes of travel. The western interurban connection with other interurbans and having steam or electric competitors will need (a) cash receipts for use on the car; (b) single and round trip tickets; (c) interline single and round trip tickets; (d) interchangeable coupon books; (e) commuter or book tickets; (f) school tickets; and (g) excursion tickets. A consistent relation in rates for each kind of ticket has been specified in the preceding sections.

The interline tickets and interchangeable coupon books are required for steam competitors. The commuter tickets are required to build up a travel of wage earners working in one place and living in another. Excursion tickets are required for those who might not otherwise ride, and school tickets are ordinarily an unprofitable concession to education.

The profit from traffic should not be estimated too narrowly on a cents per passenger-mile basis. If a car receives all its load at the terminal and does not pick up passengers along the way, the space taken by the passengers is worth as much whether he rides all or part of the trip.

Excursion rates and car-load rates are subject to the greatest variation and the cost of such business may be figured progressively lower as one in turn omits interest, depreciation, general expense, track maintenance and other items that are not affected sensibly by the operation of an additional car over the road. If platform wages, power and car repairs are figured as the only cost of the additional service, very low mileage rates may be made.

A company may make money on excursions at half a cent a mile where it is losing on regular travel at two cents a mile. For the same reason, commuter travel at a cent may be a desirable addition to the business where general travel will hardly yield a profit at a cent and a half. By commuters we mean those persons traveling back and forth between work and home every working day. The lower rate enables certain people to take employment in the city when they could not afford to pay fares at full rates out of their daily wage, and enables workmen in the city to move to the country when otherwise they would locate along some city line reached by a five cent fare.

Roads differ greatly in regard to the possibilities of commuter travel. On some, a large feature can be made of this business; on others, it is not worth while to even put the books on sale.

The rate which may be profitable for one road may be unprofitable for another and, in each case, the distribution of the population along the road and the character of the travel must be studied carefully to determine the rates charged. The heavier the travel and the more miscellaneous its character, the greater reason for making a uniform and low rate for all classes of travel. On the other hand, the less the density of the population, the greater reason for making an initial single trip high rate for the occasional traveler and seeking to create, in addition, a large regular travel by other forms of lower rate tickets.

## CONCLUSION.

In conclusion we may state, that before attempting to fix rates, the first thing is to study the density of the population along the line, and its location, to estimate how much will be through travel, how much short-ride travel out of the terminals, how much loading and reloading of passengers will occur in the course of the trip, what pleasure resorts exist, or may be built up, what commuter travel will be created, that is, working people in the city drawn into the country to live, and country people securing employment in the city, and all of these and other elements are more vital in determining the rates of fare than the car-mile cost, trip-seat cost, or the seat-mile cost. In fact, the character of the travel, should determine the kind of road built, and the choice of rolling stock. After a study of all the conditions a determination must be made of various kinds of tickets to be sold and the gradation of rates between them.

Ticket offices should be established wherever ticket sales will justify it, and in the Middle West, about 60 per cent. of receipts are collected through such offices. Reasonable care will insure that such receipts reach the treasury of the company.

Large sums remain to be collected by the conductors on the cars from passengers boarding them where ticket offices cannot be maintained, and from passengers failing to buy tickets where they are sold. Every safeguard should be provided for such collections in order to check fully the work of the conductors.

The cash fare receipts issued on the cars should show at least *from* what point *to* what point fare is paid and the auditor's stub must give corresponding information. The tickets and stubs turned in by the conductor will then show how many passengers should be in the car at each *point* along its trip. An actual count of passengers at one or more points thus affords an exact check on the conductors' returns.

VICE PRESIDENT SHAW:—We will now take up the paper on "Municipal Ownership in Great Britain and in the United States," by William J. Clark, of New York City.

MR. CLARK:—Since we first met some twenty-five years ago, you gentlemen and those associated with you have accomplished more in developing local transportation facilities, with all their attendant public blessings, than has been accomplished in all the other countries of the world combined. This brief statement practically tells the whole story as to whether or not private enterprise or municipal ownership best serves the public interests. I will not impose upon you by reading this paper, if you will pardon me for not doing so, because it is principally composed of statistics which convey more meaning in print than when verbally stated.

I would, however, like to take the opportunity of making a few offhand remarks as regards the attitude of the labor leaders in this country and abroad on this great question, an important phase of which is consideration of the labor problem. Dealing more directly with the labor leaders engaged, in the work of the investigating commission of which I have been a member for the last two years, I must say that no men worked more thoroughly and honestly on our investigation than did the labor leaders, and I believe, gentlemen, that the most valuable contribution to the literature on this great subject is that which will soon appear from Professor John R. Commons and Mr. J. W. Sullivan, both eminent labor leaders. There is actually more solid meat, more truth, in their report, and more actual facts that go to the point, than are concentrated elsewhere. I might also state that of the committee the only man I knew to change his mind, as the result of the investigation, was one of the labor leaders.

## MUNICIPAL OWNERSHIP IN GREAT BRITAIN AND IN THE UNITED STATES.

By William J. Clark,
New York, N. Y.

It is a great pleasure to once more address my old friends, the members of this association.

Since we first met, some twenty years ago, you have accomplished more in producing local transportation facilities than has been done in all other countries of the world combined, thus promoting the public welfare, general progress and development of the country to an unprecedented degree.

This brief statement in itself practically answers the question as to whether or not municipal ownership or private enterprise best serves public needs in that field where you have accomplished so much.

All virtues are not possessed by any particular class of mankind, or are attendant upon any specific form of public policy; neither are all vices and shortcomings.

Fewer serious evils exist, however, in connection with the development of public utilities by private enterprise in this country than are found connected with municipal ownership and operation either here or, in its greatest stronghold, the British Kingdom.

Comparison of municipal with private ownership of public utilities should naturally be made on economic grounds alone, based upon the actual results secured therefrom; for the worth of partially demonstrated theories is, of course, but speculative at best.

How impossible it is to thoroughly treat all that is covered by my text within the time alotted me here, is best illustrated by stating that there will shortly appear a printed report of nearly three thousand pages upon municipal and private ownership, made by a committee, of which I have the honor to be a member. Yet this report, voluminous as it is, does not by any means exhaust the subject.

### MUNICIPAL OWNERSHIP IN THIS COUNTRY.

Contained in the report is much valuable information concerning certain municipally owned American gas, electric light and water supply plants that were investigated, which clearly demonstrates that, with the exception of city water works, municipal ownership is not a success financially or otherwise, and even as regards water supply, the showing made by the municipal plants was not so favorable from either a sanitary or financial standpoint as that of the company water works which were investigated.

The baneful effects of political control and management appear in connection with the municipal plants investigated, and are quite fully set forth in the report mentioned.

Turning to United States census bulletins of 1902 and 1903, giving statistics upon towns and cities of 8,000 population or over, it is seen that the cost of their municipal water works was $508,469,415, and their estimated selling value is $499,925,742.

The cost of municipal gas works is stated as $43,018,673; their selling value is estimated at $30,186,567. But on municipal electric lighting plants the cost is stated as $10,670,954, and their estimated selling value is $13,614,064.

No further comments on the last feature are necessary other than to say that the disinterested experts of the committee found great shrinkages in values from original costs on every municipal electric lighting plant which they investigated.

The same bulletins show that the estimated value of all municipal industrial enterprises in American towns and cities of 8,000 population or over, is $707,511,949.

The annual revenue therefrom is stated as $60,725,802; the operating expenses as $28,352,317; earnings from operations, $31,965,581.

According to the same United States census reports the average rate of interest paid on municipal loans is 4.1 per cent., so from the earnings should be deducted $29,007,090 for interest; leaving an apparent net income of $2,948,491.

If a depreciation of 5 per cent. on the estimated value of the plants were allowed for, such depreciation would be $35,375,597, so that the actual deficit from operating such municipally owned plants would show as $32,427,106.

There are no municipally owned street railways in the United States, at least only one with a trifle of trackage. So, on that industry in which you are most interested, we must turn to the United Kingdom for information, and naturally you wish this feature treated more thoroughly than the other municipally owned public utilities.

Before proceeding to do this however, a glance should be given to the comparative development of the more important other public utilities in the United Kingdom and in this country.

In the United Kingdom there are about 1,400 water supply undertakings, approximately 1,100 of which are municipally owned and represent an investment of about $400,000,000. The investment in the 300 company plants is about $250,000,000.

In the United States there is a total of over 4,000 water supply plants, about equally divided in ownership between municipalities and companies.

The present investment of American municipalities in their water works is about $650,000,000, or the equivalent of the entire investment in water works of the United Kingdom.

There is a total of about 730 gas plants in the United Kingdom, of which 265 are municipally owned and having an investment of approximately $200,000,000.

The 465 company plants have invested about $410,000,000. The total investment for gas plants in the Kingdom is say $610,000,000.

There are about 1,000 gas plants in the United States with an investment of nearly $1,000,000,000.

In the United Kingdom there are 268 municipally owned electric lighting plants with an approximate investment of $177,400,000.

There are 206 company plants with an approximate investment of $110,000,000. The total investment in the United Kingdom in electric lighting is $277,400,000.

In the United States are about 4,000 electric lighting stations representing an investment of over $1,000,000,000.

The total kilowatt output of the American stations is some eight or nine times greater than that of the British stations, so it is seen at a glance that far greater practical results are secured from the American investment in the electric lighting plants than is the case in the United Kingdom.

It is obvious that the greatest advantages and benefits which the public derive from the existence of local transportation facilities are directly proportionate to the extent that these are available to it; this to make local travel itself possible at low rates of fare, and incident thereto, aiding on such important matters as public enlightenment through readier intercommunication; redistribution and scattering of congested population; improved sanitation; making the ownership of homes possible to the humblest; extending the area available for employment to the laborer, and increasing taxation revenues through the improvement and increased values of real estate.

These are the most important economic features involved in the local transportation problem.

American progress in this respect has been accomplished by private enterprise without imposing financial burdens upon public treasuries, or increasing local taxation.

British development of local transportation has been hampered by the municipalities where undertaken by private enterprise, or favored by every unfair means at their command when undertaken by the municipalities themselves, at serious risk to and great expenditures from their treasuries, accompanied by increased taxation.

Compare the results arising in the two countries from the widely varying policies that have been respectively followed and you will find, that in 1902, the last year when official figures thereon are available, the urban population of the United Kingdom was 29,144,726; that of the

Continental United States was 33,850,000, and this latter included smaller communities than in the former.

The total length of tramway track in the United Kingdom was 2,336 miles or one mile of track for 12,476 of its urban population. At the same time there was only one car for each 3,760 of the urban population.

The United States then had 22,328 miles of electric railway track, or one mile for 1,516 of its urban population, and a car for each 574 thereof.

In short, the urban resident of the United States had comparatively eight and one-half times greater trackage facilities available to him for travel than had the urban resident of the United Kingdom, and six and one half times the number of cars.

From 1890 to 1902 the increase of trackage in the United Kingdom was but approximately 56 per cent.

During the same period the corresponding increase in the United States was about 200 per cent.

From 1902 to 1906 the length of trackage in the United Kingdom had increased 1,256 miles.

In the United States during the same period the increase was approximately 12,500 miles or ten times greater than in the United Kingdom.

In 1902 there were two cities of over 100,000 population in the United Kingdom without street railways. In the United States there were none.

In the United Kingdom there were seven cities of from 50,000 to 100,000 population without street railways. In the United States there were none.

In the United Kingdom there were 39 cities of from 25,000 to 50,000 population without street railways. In the United States there were none.

In the United Kingdom there were 295 communities of from 8,000 to 25,000 population without street railways. In the United States there were 21.

Next in importance to the creation of transportation lines is, of course, the service rendered thereon.

In the United Kingdom where the greatest of handicaps and hardships have been placed upon the local transportation companies, and where the municipalities have acquired the cream of the properties with the densest traffic, the average headway between cars is at present about one-third more frequent upon the company owned lines than upon those operated by municipalities.

## British Conditions of Service Contrasted with American.

In 1902, the last year when full comparative figures are available the total car-miles run upon the tramways of the entire Kingdom was 145,127,423.

Upon the local transportation lines of America, 1,444,430,466 car-miles, or nearly eight times a greater number were run to accommodate an urban population, but a trifle larger than that of the United Kingdom.

A total of 1,394,452,983 passengers were carried on the tramways of the United Kingdom.

On the street railways of the United States 5,521,509,521 passengers were carried. Of this last, however, 1,062,403,392 were on free transfers; a number practically equivalent to 90 per cent. of the entire number carried in the United Kingdom.

On the basis of passengers carried per year, the American street railway car averaged but slightly more than one-half the number of passengers carried by the tram car of the United Kingdom. That is, the American car averaged 93,586 passengers per year as against 182,463 passengers per car in the United Kingdom.

### COMPARATIVE COSTS OF SERVICE RENDERED.

Making due allowance for the more favored conditions surrounding the existence and operation of British municipal properties the rates of fare upon British company systems are comparable with those of the municipalities.

On this most important feature it is therefore demonstrated that despite all of the disadvantages under which they labor, British tramway companies are doing comparatively as much for the public on low fares as are the municipalities.

The average receipts per passenger on all tramways in the United Kingdom were 2.25 cents as against 3.76 cents in the United States. However, 9.65 passengers rode per car-mile in the United Kingdom as against 5.2 passengers per car-mile in the United States.

Gross receipts averaged 21.81 cents per car mile in the United Kingdom as against 19.55 cents per car-mile in the United States.

The British passenger paid about 60 per cent. of the rate of fare paid by the American passenger; but as above stated, the facilities for travel available to him were only from 12 per cent. to 15 per cent. of those enjoyed by the American urban resident.

From 1890 to 1902 the increase in length of local transportation lines in the United Kingdom was but 536 miles. Similar increase in the United States was 10,755, or nearly twenty times as great. During the same period the average fare per passenger in the United Kingdom had decreased about 35 per cent. In the United States, despite rapidly increasing cost of essentials to operation and greatly increased facilities, it had yet decreased about 26 per cent.

It should be appreciated that it costs far more to operate local transportation service in America than in the United Kingdom. Rates of wages in this particular industry are at least double in this country those paid for similar purposes abroad.

As the result of fairer treatment before the courts the rate of damages per car-mile for personal injuries in the United Kingdom averages about one-third of what is paid by American companies.

So near as can be estimated the operation of an American street railway costs about 65 per cent. more than should a similarly situated property in the United Kingdom.

So it is seen that considering the cost to them of service rendered by American street railway systems the rates of fare charged are comparatively as low as those prevailing in the United Kingdom, while far greater facilities are afforded the public.

From what has been stated it is apparent that the legitimate objects for creating and operating local transportation lines have been more thoroughly met by American private practice than has been accomplished through British municipal methods. But there are other phases of the situation which should be considered.

Prominent among the arguments which are always advanced in favor of municipal ownership and operation are the alleged financial advantages which accrue to municipal treasuries therefrom.

Unquestionably there are a few instances where municipally owned public utilities have brought an actual return from their operation to municipal treasuries.

It would be strange indeed if this were not so, but these cases are rare and I have never known an instance where, if, in the statements of their capital and operating expenditures due allowance were made for assistance rendered them toward a favorable showing, from other municipal accounts and branches of the city government, the showings would not be far less favorable.

Investigation of specific municipally owned undertakings and the results derived from their operation are of little value on determining the entire question of municipal ownership, or of direct value, unless permission were given to get at the actual basis of, and details followed in, their accounting.

I have never known such permission to be granted in the United Kingdom. In fact many pages of sworn testimony exist in the reports of parliamentary hearings which show that even the government auditors do not attempt to see if expenditures of municipalities are distributed to proper accounts.

The most honest, best intentioned municipal officials of the Kingdom, unconsciously perhaps, permit their public utilities to receive most important financial benefits from other branches of the city government, whose expenses are paid for out of general public funds, or they, knowingly, adopt a policy of this character and carry it to the extreme, considering it moral from the standpoint of municipal practice, although these same men would condemn anything of the sort attempted in ordinary private business.

For these, and kindred reasons, the best way in which to obtain some light on the net financial results derived by the municipalities from municipal ownership in the Kingdom is to inspect their financial condition before and after municipal ownership became a dominating factor therein, drawing some incidental comparisons with American conditions.

Municipal ownership in the United Kingdom has brought burdens of local debt and taxation which are hardly grasped by the average American.

To fully appreciate how onerous these burdens are, a glance should be given to those other burdens of debt and taxation which the British citizen bears in connection with his national government before the other weighs down upon him.

In 1905 the national debt of the United Kingdom averaged $91.68 per capita of its population. That of the United States was $11.91 per capita.

The expenses of the national government for the United Kingdom averaged $13.80 per capita. In the United States this was $6.67 per capita.

Turning now to municipal indebtedness and taxation, the present amount of the local indebtedness of the United Kingdom is probably not far from $2,800,000,000, or say approximately $98 per capita of the urban population. About one half of this has been incurred for municipal trading enterprises.

In 1903 the amount of such indebtedness was $2,200,000,000, or approximately $79 per capita of urban population.

In 1902 the total amount of local indebtedness of the United States was $1,439,504,991, or $43.53 per capita of urban population.

In contrasting the local indebtedness of the respective countries, and their expenditures for local government, it should not be forgotten that America expends for school property and educational purposes enormous sums, while such expenditures in the United Kingdom are comparatively small.

The value of school houses in the United States was approximately $450,000,000 in 1902.

In the United Kingdom the value of similar property was about one-third that figure.

It should also be remembered that in rapidly growing American cities the legitimate demands for improvements and consequent expenditures should be far greater than in old well established British communities.

According to official estimates in 1902, the value of the realizable assets of British municipalities exceeded their indebtedness by approximately 23 per cent.

The realizable assets of American municipalities exceeded their indebtedness by about 40 per cent.

The United States Census Bureau estimates that in this country for each $100 of national wealth there is public indebtedness of every name and nature amounting to only $2.85. In the United Kingdom corresponding debt averages $10.50 for each $100 of national wealth.

In 1880 the total local debt of the United Kingdom was $684,670,350, or about $19.56 per capita of the total population. In 1902 it was approximately $2,200,000,000 or about $52.64 per capita; showing a total increase in amount of $1,504,740,825, or approximately 219 per cent., and an increase per capita of $33.08, or 169 per cent.

In 1880 the total local indebtedness of the United States was $724,427,848 or $14.44 per capita of the total population. In 1902 it was $1,439,504,991 or $18.24 per capita, showing a total increase of $15,077,143, or 97 per cent., and an increase per capita of only $3.80 or 26⅓ per cent.

British local indebtedness is now increasing at the rate of about $150,000,000 per year or about $3.25 per capita of the entire population.

The local indebtedness of the United States is increasing at the rate of about $70,000,000 per year or less than 90 cents per capita of the entire population.

In the fiscal year of 1881–2 the total expenditures for local government in the United Kingdom representing the amounts raised from taxation and received from the national government for local purposes also raised by taxation, amounted to $333,327,495 or $9.45 per capita of the entire population.

In the fiscal year of 1902–3 the total expenditures for local government were $760,825,000 or $18 per capita of the entire population, showing an increase in total of $427,497,505, slightly over 128 per cent. and per capita of $8.55 or say 90 per cent.

During the same period the rate of taxation upon assessed valuation of property had increased over 60 per cent. and the rate of assessment had been increased.

In the same period the increase in amount raised by local taxation in the United States averaged but 45 per cent. per capita; and the rate upon assessed valuations had increased but 12 per cent., while rates of assessment had decreased.

*These figures conclusively demonstrate the fallacy of the theory that British municipal ownership has relieved local taxation and improved the financial condition of municipalities. The proof is all to the contrary.*

No statistics exist which fully cover all the public utility undertakings of local authorities throughout the Kingdom, but the Parliamentary Return of 1902, "Municipal Corporations Reproductive Undertakings of England and Wales" shows for that part of the Kingdom alone the following:

| | | |
|---|---|---|
| The total investment in such undertakings was | | £121,172,372 |
| Amount of loans repaid | £16,246,579 | |
| Amount of sinking funds | 4,644,835 | |
| | | 20,891,414 |
| Amount unpaid for which provision has not been made | | £100,280,958 |
| Total annual receipts from operation | | 13,040,711 |
| Operating expenses | £8,228,706 | |
| Interest paid | 2,975,906 | |
| Set apart for depreciation | 193,274 | |
| | | 11,397,886 |
| Official statement of earnings from operation or about 1.36 per cent. on the total capital invested and 1.64 per cent. on that not paid or provided for | | £1,642,825 |
| Loans were repaid to the amount of or 1.04 per cent. on the total capital investment. | | 1,264,544 |
| Showing a net profit of only | | £378,281 |

It should be noted that small as the showing of profitable return upon an enormous investment thus is, less than one-fifth of one per cent. has been allowed for depreciation in making that showing.

If an allowance of 5 per cent. had been made for depreciation, a figure more nearly correct, the amount which should have been deducted for this important item would be £6,058,618 instead of £193,274 as shown by the Parliamentary Return. Consequently, instead of there having been earnings from operation there was properly a deficit of £4,222,519, or about 3.45 per cent. on the entire capital investment or 4.22 per cent. on the remaining investment.

It should be observed in this connection also, that the actual deficit would be about three and one-half times as great as the sums annually set aside for repayment of loans. These actual conditions despite all complicated and misleading systems of accounting must ultimately show in the general financial condition of the municipalities.

A favorite financial argument of the municipal ownership advocates is that, owing to the superior credit of municipalities they can more readily secure capital for the creation of public utilities than can be done by companies, and upon a more favorable basis, with less risk to the investors in securities.

This should seemingly be so, but let us note what the present selling values of British municipal securities are, bearing in mind that none were issued below par.

The London Stock Exchange daily official list for October 1, 1907, contains quotations upon 151 municipal securities.

Of these 9 were quoted at par or above.

22 from 95 to 99.
9 from 90 to 94.
60 from 85 to 89.
38 from 80 to 84.
8 from 75 to 79.
4 from 70 to 74.
1 below 60.

Among these are some remarkable quotations.

| | |
|---|---|
| Certain London securities at.................. | 72 to 74 |
| Certain Glasgow securities at................. | 77 to 79 |
| Certain Liverpool securities at................ | 74 to 76 |
| Certain Manchester securities at............... | 86 to 88 |

It is thus seen that British investors have suffered enormous losses from the shrinkage in values of municipal securities and that the credit of the municipalities has consequently been impaired.

There is an important feature of municipal finance involved in this connection which is generally overlooked.

In all cases where parliament has authorized municipalities to make loans for public utility purposes, it is provided that a sinking fund must be set aside to ultimately pay off the indebtedness; rarely, however, is any provision made concerning the manner in which such sinking funds are to be invested and municipal authorities consequently handle them in accordance with their own unrestricted ideas.

It should be said also that parliament in fixing the amounts to be contributed to sinking funds, and the time for their completion, rarely considers that a good share of the physical property of any public utility must be replaced one or more times before the original debt has been offset through the workings of the sinking fund.

Almost invariably these sinking funds are invested in municipal securities, and these, frequently are some issue of the same municipality for other public utility purposes. Consequently shrinkage in the value of municipal securities has seriously reduced the actual amount of these existing sinking funds, yet so far as I have been able to ascertain in all official statements thereon, this fact has not been stated.

As regards municipalities investing sinking funds in their own securities, it is needless to remark that this is not in accordance with sound financial practice.

It is clear to be seen that the insufficience of sinking funds to care for the original cost of properties, plus the additions required for renewal of certain portions thereof which have not been provided for, will ultimately create a financial condition thereon far different from that originally expected.

Once more dealing more directly with that particular public utility in which you are most interested at the latest period when official data is available thereon.

The last Parliamentary Report on the Tramways and Light Railways of the United Kingdom covering the fiscal year ending March 31, 1906, so far as municipal properties are concerned; and that ending December 31, 1905, for the tramway companies, shows that the municipalities had only 2,499 miles of track.

On a basis of $5 to the British sovereign, the existing capital obligations of the British municipal tramways are shown as $177,199,735, averaging say $70,840 per mile of track.

As is well known, in nearly all of the larger British cities the municipal authorities have acquired previously existing tramway systems owned by companies.

This under a form of legalized confiscation authorized by the "Scrap Iron" clause, so-called, in the Tramway Act of 1870. As a result, only $14,896,745 of the total capital expenditures made by the municipal tramways is shown as being paid for all the pioneer work done and properties created by the tramway companies, that have since been acquired by the municipalities.

Had British municipalities been obliged to pay for what had preceded them in tramway work and investment, proportionately to what has been done in this country, their total capital investment in tramways would now be at least $260,000,000.

In connection with the development of British tramways it has been necessary to do much street widening which should properly be charged to tramway capital accounts.

Tramway companies there have been obliged to pay for such expenditures. But it is rare where municipal tramways have had to assume much of such expense, for the total charge to the capital accounts of the municipal tramways for this item is only $3,750,460 for the entire Kingdom.

It is an established fact however, that in London alone about $20,000,000 was expended for street widening on account of the tramways, which has never appeared in the tramways capital account. At Liverpool the same condition exists to the extent of about $5,000,000.

If all the British municipally owned tramways bore a pro rata charge for street widenings to that imposed on the London United Tramways Company (Ltd.), there should be added to the total of their capital account about $70,000,000, which has been assumed as ordinary local indebtedness, or partially paid for out of general local funds raised by taxation.

To put the situation more clearly, British municipalities have apparently confiscated about $70,000,000 to $80,000,000 in tramway values, and in stating the capital investment in their municipal tramways have omitted to say that $70,000,000, which should have been included therein, has gone into general public improvement or similar accounts.

Consequently had British municipalities proceeded to acquire their present 2,499 miles of tramway properties on the same basis as British and American companies have been obliged to follow their total capitalization would easily reach $330,000,000, or say $132,000 per mile of track.

The average per mile of track in the United States of stocks and bonds issued against street and elevated railways is less than $107,000 per mile of track.

The results from operation of British municipal tramways during the fiscal year ending 1906 were, according to official statements:

| | | |
|---|---|---|
| Gross receipts | | $34,267,430 |
| Operating expenses | | 21,618,670 |
| Net receipts | | $12,648,760 |
| Rental of leased lines, etc. | | 510,410 |
| Income from operation | | $12,138,350 |
| Interest charges | $4,201,125 | |
| Reserve for renewal and depreciation | 3,118,085 | |
| | | 7,319,210 |
| Net income | | $4,819,140 |

Which was applied as follows:

| | |
|---|---|
| To repayment of debt and sinking funds | $3,316,680 |
| Relief of taxation | 1,029,905 |
| Other matters and balance carried forward | 482,935 |

Under the whole theory of British municipal ownership finance, ample allowance for depreciation must be made and full contributions to sinking funds maintained, or the theory absolutely fails in practice.

Inspection of the above figures reveals the fact that only 1.8 per cent. on the capital investment has been allowed for depreciation and renewal.

If an allowance for this of 5 per cent. had been made, an addition to the renewal and depreciation fund of $5,667,840, is necessary, thus changing the net income as stated to a deficit of over $800,000, preventing the making of legitimate contributions to sinking funds or for other purposes.

If taken into account, as should be done, that $70,000,000, which should have been charged to tramway capital account has gone to general municipal accounts, and estimate the interest on this capital at 3 per cent., it is seen that at least $2,100,000 should be added to the deficit resulting from the operation of tramways as shown above.

It is thus apparent that British municipal tramways, taken as a whole, are operated at a serious actual loss and that excepting in a few specific cases, payments to sinking funds or to relieve taxation have not been actually earned.

Based upon the official figures, which have been shown to be entirely unreliable, all the financial returns received by the municipalities of the United Kingdom from the operation of both company and municipal tramways, including local taxation thereon, repayment of debt or contributions to sinking fund, reserve, depreciation and renewal funds, and relief to local taxation, etc., average but approximately $925 per mile of track annually.

From the closest possible approximation, which can be made in the United States, the average financial benefits which its municipalities receive from the taxation of and other contributions from street railways, and from taxation of their securities, the average is approximately $1,295 per mile of track annually, or $370 per mile of track greater than that shown as similarly received by the municipalities of Great Britain.

The last remaining important economic advantage claimed for municipal ownership, is improvement in the conditions of the laboring man, and with this is always coupled the statement that there are no politics in connection with British municipal affairs, and no political dangers involved by greatly increasing the number of municipal employes.

Rates of wages have increased and hours of labor have greatly decreased in connection with the operation of public utilities during recent years, both in this country and in the British Kingdom.

It is questionable if these net benefits to labor since the introduction of electricity have been greater on British municipal tramways than upon American street railways.

There is no question, however, but what British municipal ownership has unfairly created a class of privileged municipal employes at public expense, and the detriment of their fellow laborers not employed by municipalities. At least this has been so stated to me by prominent American and British labor leaders.

As to whether or not a grave public danger exists in connection with the creation of such a class, is best illustrated by reading extracts from one of the circulars of the Municipal Employes' Association, advancing arguments for increasing its membership:

> "Because unity is strength."
>
> "Because the officers of this association have worked for years for a municipal body, and therefore know the way to approach and deal with local authorities for you better than others who have never worked for a public body."
>
> "Because it is estimated that there are nearly 2,000,000 municipal employes in the United Kingdom. What could they not do for themselves if altogether?"
>
> "Because concessions, estimated to cost the municipal authorities upwards of £2,000,000 per annum have been obtained by us."
>
> "Because we have never been defeated by a municipal body yet. If they decline a request to-day we are up and at them again to-morrow."
>
> "Because there is no need for strikes with us. We can get what we want without them, if we are united, by returning to the council men who are in favor of fair conditions of employment."
>
> "Because we get concessions; not shout and rave about them."

A still greater political and public danger rests in the Association of Municipal Corporations and Town Clerks, and kindred organizations, which are more powerful in their influence on parliamentary legislation than any American party or political ring has ever been in national or state legislation.

The votes of the 2,000,000 municipal employes mentioned above are practically controlled by them.

The town clerks and other prominent salaried officials of the municipalities dominate the policy of their association.

These men also generally dominate the parliamentary politics in their respective localities and members of parliament rarely reside in the localities from which they are elected.

As a result of this condition, the political future of the great majority of parliamentary members is principally dependent upon the attitude towards them of these associations.

In addition to this, cash, legal, engineering and other talent are contributed by the members of the association for the services of some specific member in promoting or opposing legislation, affecting only the particular locality of that member.

Time does not permit me to go into the details of how these influences have placed upon private utility companies the most unfair of burdens in securing franchise rights or in conducting their business when these have been secured, nor how these influences have obstructed progress to the great detriment of the public at large.

The unwise investment of enormous public funds with the attendant evils brought about by these influences has already been stated.

The American visitor who has been royally entertained by high class, non-salaried elective municipal officials, and who has not gone deeply into the entire system of British municipal government, may doubt the existence of the situation described; but thorough investigation will reveal it in even more serious form than it is here stated.

The real motives which have animated the great power behind the British municipal ownership movement, have emanated from *those who expected personal benefit therefrom, and these motives are as intensely selfish as those which have ever led to the organization of a private company, or have dictated the action of professional politicians in this country.*

VICE-PRESIDENT SHAW:—Gentlemen, you have heard Mr. Clark's remarks and the portion of the report which he has read. I am sure we are all greatly indebted to Mr. Clark for having made this compilation for us, and for giving us the information contained in this paper. Is there any discussion?

MR. ELY:—A short time ago while some of us were considering the reports of the Committees on Public Relations and Municipal Ownership, it occurred to us that a paper upon Municipal Ownership by Mr. William J. Clark would be a very desirable thing; an enlightening and powerful thing, at this juncture. Mr. Clark was communicated with only a short time ago. It was almost an indelicate thing to impose upon his well known good nature to such an extent, but with the proverbial willingness to undertake labor in the interest of the general good that has always characterized the gentleman, he went to work and the result is this splendid paper. It seems to me, under all the circumstances, Mr President, some special recognition should be spread on the records of this meeting, and I would move that a vote of thanks be extended to Mr. Clark for his very great kindness in preparing this paper and coming here to read it to us.

(Motion unanimously carried.)

VICE-PRESIDENT SHAW:—The next order of business is the report of the Committee on Municipal Ownership which will now be presented by the chairman, Mr. W. Caryl Ely, of Buffalo.

MR. ELY:—The report of the committee was read and considered yesterday at the executive session. The Committee on Municipal Ownership has covered considerable ground included in the report of the Public Relations Committee. You have heard several papers along these lines, and as it is getting late I think the reading of this report had better be dispensed with. I can say, briefly, that the report deals principally with the important movement that is on all over this country in the way of regulation and control through public service commissions, and is suggestive of possible desirable action on the part of this association along several lines. The existence of that movement is present to every man's mind. It needs no gathering of data in the way of expressions of opinion, because the fact that in 35 states during the past year regulative measures in one way or another were passed, affecting corporations in one way or another very drastically, and that in 11 or 16 states (I speak from recollection only and cannot be definite) boards of railroad commissioners were created and that in 11 or 16 states the powers already possessed by existing boards of railroad commissioners were enlarged considerably, is enough to show that the movement is so widespread and general that in every state the possibility of it and the probability of it is existent and at hand. What the policy of the association should be in regard to it, if any, is a question, and the report of this committee, addressed to such a delicate point, was intended to bring it pointedly to the attention of the members of the association with the view of ultimately assisting in the formulation of a policy. I would like to say, Mr. President, that our report will be revised and printed with the other papers presented here if that is the proper course of action and would move that the matter take that course.

(Motion seconded and carried.)

## REPORT OF THE COMMITTEE ON PUBLIC RELATIONS.

*To the American Street and Interurban Railway Association:*

Gentlemen.— It has been considered by your committee that the subjects naturally within its scope are those indicated by its title, namely: our relations with the public as distinguished from those matters pertaining to our internal business operations. These external or public relations in the minds of your committee naturally subdivide themselves as follows:

1. Our relations with that portion of the public served by our several lines of transportation; in other words, our patrons.
2. Our relations with governmental bodies, federal, state and municipal.

Under the first heading are embraced such questions as service, rates of fare, transfers, rules and regulations governing the service in so far as they apply to or directly affect our patrons, and in general our methods and ways of transacting our business as affecting our patrons and those persons who are residents of our several transportation districts.

Under the second heading are naturally grouped such subjects as franchises, taxation, including all public burdens and impositions, capitalization, service, rates of fare, public regulation and control. The events of the past year have caused the last mentioned subject to occupy a position of all absorbing interest and importance.

The contention for the enlargement of the powers of the Interstate Commerce Commission is familiar to you all and need not be further adverted to here. In addition to this a series of events relating to the management, operation and control of corporate enterprises has directed the attention of all people throughout this country to the subject. The legislatures of more than a dozen states during the past year have enacted laws which in some way or other directly provide to some extent for the supervision and control of corporations engaged in the business of transportation. In some states this legislation has embraced nearly, if not quite all, of the so-called public utility corporations. It may be, and undoubtedly is, a fact that this riveting of public attention upon this particular subject has in a large measure been brought about by a better understanding on the part of the American public of the facts and conditions concerning municipal ownership and its inapplicability in this country and under the conditions prevailing here to this particular species of property. Public regulation and control and municipal ownership are intimately related. Indeed it would seem that the one is the alternative of the other. We believe in fact that it is so now generally conceded and this seemingly almost universal turning away in this country from attempts at municipal ownership toward practical regulation and control affords evidence of the highest quality of a growing, if not an already established, belief that municipal ownership is impracticable and undesirable in this country.

It is not the purpose of your committee to discuss at length any of the matters herein referred to, but we would briefly call your attention to the statutes of the three states of Massachusetts, New York and Wisconsin as affording the most pertinent examples of this class of legislation.

Massachusetts in 1864 was the first of all the states to establish a State Board of Railroad Commissioners, and in 1885 was again the first to provide a Board of Gas and Electric Light Commissioners. New York in 1882 established a Board of Railroad Commissioners, and a few years since again followed the lead of Massachusetts by establishing a Gas and Electricity Commission. During the past legislative session New York enacted a law to regulate public utilities and placed under state commissions nearly all public utilities, the telegraph and telephone companies being almost the sole exceptions. The New York commissions act of 1907 differed from the previous legislations in that state and also from Massachusetts by committing the regulation and control of the railroads as well as the other public utilities to the same commission, and divided the state into two commission districts, but made the subjects of commission jurisdiction the same in both districts. The New York law at the time of its passage was by far the most comprehensive piece of legislation of the kind that had been enacted up to that time. It conferred upon the Public Utilities Commissioners all the powers that had heretofore been invested in the Board of Railroad Commissioners and the Gas and Electricity Commission, and in addition thereto vested in the commissioners the power to fix the capitalization of such corporations both in stocks and bonds, and also the power to make rates and specify and regulate service. It prohibits the capitalization of franchises except in such amounts as had actually been paid by any corporation to the public for any particular franchise possessed by it.

Later in the year the legislature of Wisconsin passed a Public Utilities Law regulating heat, light, water, power and telephone companies, and another law bringing telegraph companies and street rail ways under the same provisions as steam railways and interurban electric lines, and bringing all these public utilities under the jurisdiction and control of the State Board of Railroad Commissioners. The Wisconsin law goes further than either the Massachusetts or New York laws in that it provides for the physical valuation of the properties of such corporations, and provides for a complete system of uniform accounting with special requirements as to depreciation and construction accounts. It also provides for the so-called sliding scale by authorizing the commission to investigate and sanction such devices; confers the power to regulate rates, fares and charges and establishes what it terms the indeterminate permit, which it defines to be "the right to continue in business until such time as the municipality exercises its option to purchase the property at a just compensation to be determined by the State Commission." This is a most important provision and one far in advance of anything heretofore attempted in any legislation in this country. Under the indeterminate permit feature corporations operating under existing franchises are permitted to surrender them and to receive in place and in lieu thereof by operation of law an indeterminate permit, agreeing thereby to sell to the municipality in the manner therein provided and "to waive the right to insist on the fulfillment of any contracts regarding rates or services which might be set up as a defense against the orders of the State Commission." In return the corporations obtain protection against unnecessary competition on the part of other corporations or municipal plants, the question of necessity to be decided by the commission. This indeterminate permit provision does not apply to telegraph or telephone companies. In fixing rates the Wisconsin commission is empowered to act absolutely instead of fixing merely maximum rates as provided by the New York law. An exhaustive statement concerning this Wisconsin legislation, the method of its enactment and the objects sought to be achieved by the legislation is contained in an article upon the subject appearing in the American Review of Reviews for August, 1907, by Professor John R. Commons, Professor of Political Economy in the University of Wisconsin.

A public utilities commissions bill is at present writing pending in the legislature of New Jersey, and there are well authenticated statements concerning the preparation of bills upon the same subject to be introduced at the coming sessions of the legislatures in other states.

Under these circumstances it is not the purpose of your committee at this time to discuss the questions academically. It is a condition and not a theory that confronts us. The powers sought to be conferred upon commissions by legislation of the character above referred to are so far-reaching as to overshadow at the moment any and all of the subjects within the purview of your committee; indeed nearly all of them are in part or in whole embraced within the scope of such legislation.

In view of the importance of the subject, its delicacy and its far-reaching effects upon street railway properties it would seem to be wise for your association at this time to consider the adoption of some coherent and well defined policy with reference to the matter.

During the past year the Committee on Public Policy of the National Electric Light Association has devoted a great deal of attention to this subject, and the reports of that committee and its sub-committees on municipal ownership and on public regulation and control are respectfully recommended to your attention.

The conclusions of the sub-committee on public regulation and control were stated to be:

First. That the National Electric Light Association should favor properly-constituted general supervision and regulation of the electric light industry.

Second. That if state commissions be constituted they should be appointed in that manner which will give them the greatest freedom from local and political influences, to the end that their rulings shall be without bias.

Third. That state commissions should be clothed with ample powers to control the granting of franchises, to protect users of service against unreasonable charges or improper discriminations, to enforce a uniform system of accounting and to provide for publicity. If the state provides for publicity on the one hand, on the other hand it should safeguard investments. Regulation and publicity would be a grievous wrong unless accompanied by protection.

The report of the full committee was written before the passage of the public utilities bill by the legislature of New York, and while the full committee does not in terms make recommendations embodying the sub-committee's conclusions as stated above, nevertheless its general tenor is in the line of acquiescence in the general public policy involved in the legislation of regulation and control. Mr. Everett W. Burdett, of Boston, is the chairman of the Public Policy Committee of the National Electric Light Association, and partly because of his great experience and ability, which peculiarly fit him to be a wise counsellor at this juncture, and particularly because of the excellence of the report itself, your committee has considered it wise to reproduce here, in the form of an appendix, the report itself and also the reports of two of the sub-committees.*

Your committee does not feel that it would now be justified in recommending any line of action to be pursued by this association or its members when and as it and they shall be called upon to define a line of action as legislative emergencies of this character shall arise in different parts of the country, but we respectfully urge upon you the desirability of formulating such a policy, and to that end beg leave to suggest that at this session of the convention a meeting be held of such of the administrative officers of electric railways as may be in attendance at this convention.

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*See appendix.

In conclusion the committee apologizes for its inadequate treatment of this subject, but ventures to express the hope that it may still be of assistance in your further deliberations, if any, upon the subject which has formed the burden of this report.

Respectfully submitted,
W. Caryl Ely, *Chairman,*
John B. Parsons,
Jere C. Hutchins,
Charles W. Wetmore,
Henry A. Robinson,
E. C. Foster,
*Committee on Public Relations.*

## APPENDIX.

### REPORT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION COMMITTEE ON PUBLIC POLICY.

(June, 1907.)

This committee, which was new to the association last year, was reconstituted by the president shortly after the convention held at Atlantic City in June, 1906. Its membership was made up of representatives whose lighting interests were scattered from Massachusetts to Colorado, thus securing widely separated points of view. The committee chose Mr. W. H. Gardiner, of New York, its secretary, and he has rendered most efficient service.

The character and scope of the duties of the committee are not defined by any by-law or rule of the association, and are best indicated by its name.

The committee has assumed that any subject touching the general relations of the companies to their customers, their employes, the public or the public authorities — in short, whatever involves questions of external as distinguished from internal policy — is within the scope of its consideration.

The following sub-committees were accordingly appointed:

(1) On Municipal Ownership.
(2) On Public Regulation and Control.
(3) On London Sliding Scale as Applied to Electricity.
(4) On Taxation and Franchises.
(5) On Industrial Insurance, Rewards and Pensions.
(6) On Publicity and Popular Education.
(7) On Rates and Methods of Charging.

The membership of these various sub-committees was limited to two, to insure higher efficiency than a larger number residing at considerable distances from each other. The reports of all the sub-committees have, however, been from time to time submitted to, and fully considered by, the committee at large, and, so far as possible, have been put into such form as would command the acquiescence of all the members of the general committee.

The reports of the several sub-committees are hereto appended and a careful examination of each of them is invited.

The Committee on Rates and Methods of Charging has not submitted a separate report; but it conferred with the standing committee on rates and made some suggestions about the report of the latter committee, which were adopted.

In addition to the foregoing sub-committees, a special committee of three was appointed at the request of two member companies operating in the same city, to arbitrate the differences between them, with the result that after a considerable amount of consultation, examination of the plants, accounts, and so forth, of the respective parties, the committee succeeded in suggesting an arrangement to the mutual satisfaction of the two companies.

Particular attention is called to the mass of information collected and collated by the Committee on Industrial Insurance, Rewards and Pensions, which will be found of value to any corporation considering the advisability and practicability of the adoption of some plan for the uplifting of their employes and the bettering of their condition. The committee concurs in the suggestion of the sub-committee that wherever it is possible to adopt such plans, or similar plans to those described in the report, it is well to do so; and agrees in the conclusion that the tendency with all such plans is to "lighten the burden of the employe, increase his efficiency, and safeguard the interests of the company by encouraging closer, deeper and more harmonious relations between the employe and the company which employs him."

All the other reports of sub-committees are necessarily more or less general in their character, but the committee calls special attention to the report of the sub-committee on the London Sliding Scale as Applied to Electricity, and to the great practical importance of the subject. The committee joins in urging "the very serious consideration of the application of this attractive theory to the business of the various companies interested as soon as a safe and satisfactory working basis for it can be established." If the practical details in its application to electricity can be successfully worked out, there is little reason to doubt that the relation of the companies to their customers and the public will be very much improved, with distinct advantages to both.

Attention is also called to the practical suggestions of the subcommittee on Publicity and Popular Education, respecting different methods of exploiting various subjects of common interests to the companies, their customers and the public. In this connection it has recently been well said: "The American public is in the long run fair. It errs oftener from ignorance than from malice. It is sentimental in the highest degree, and can be led by prejudice or emotion to extremes. If it has put before it clearly all the facts, its sound common sense will come to the rescue, and sentimental reformers and schemers with axes to grind will go out of business; but until corporations present their side of the case aggressively and with absolute honesty the public will follow the lead of those who make a living by attacks upon all corporations indiscriminately."

Questions of taxation and franchises, which have occupied the attention of one of the sub-committees, are of great importance. We think there should be an agreement among the parties in interest upon some of the fundamental propositions which underlie these questions, particularly with respect to the subject of taxation. It should never be lost sight of that every form of taxation of public service corporations is a tax upon the consumer. While these companies should, of course, pay into the public treasuries their full share in discharge of the general public burdens, whatever is exacted from them in the form of excises or taxes in excess of what others similarly situated are required to pay distinctly operates against reductions in charges for the service rendered or a limitation of the facilities furnished. In other words, if these public utilities must make special contributions to the public funds, it must necessarily be at the expense, in one form or another, of the particular members of the community who use their service. Inasmuch as this service is theoretically universal, in the sense of being available to all citizens desirous of using it, it should be furnished at the lowest figure practicable. The effort of every public service corporation ought to be to increase its facilities and reduce its charges as rapidly as possible, and it should not be handicapped in doing so by exactions on the part of the public at large, which reduce the ability of the companies to do so by the amounts exacted. In other words, whatever contributions public service corporations make to the public, aside from their proportion of general taxes, should be made to those who use their service. If this simple but fundamental proposition were universally recognized, there would be an end of legislation to impose special taxes and excises upon public service corporations, whose use of the public streets is, after all, required by the public for its own convenience. If, however, it shall be necessary in particular instances to acquiesce in a popular demand for special payment for the use of public streets, the public should be educated to the knowledge of the effect upon rates and facilities which the application of such a theory involves.

Another proposition which is fundamentally important, both to the companies and to the public, is that the franchises of the companies should be for such terms and upon such conditions as will best subserve the interests of both. As in the case of taxation, the interests of both are really the same. The undue restriction of franchises is analogous in its results to the imposition of unwarrantable taxes. Both operate to deprive the company of the incentive and the ability to give the public the best service at the lowest rates. A short-term franchise involves the necessity of the creation of a sinking fund, at the expense of the consumer, to protect the stockholder against loss of his investment before the end of the period of natural use. It also removes all incentive for the company to make permanent improvements, particularly in the latter part of the term of its franchise. A short-term franchise operates to induce the company to adjust its charges in view of the limited time in which it is permitted to recoup its investment and make its profits. The natural results are higher prices, larger reserve funds, poorer equipment, less efficiency of service, than would be the case if the tenure of the company were more extended. A long-time limited franchise is subject to the same objections, except that the inevitable day of inadequate equipment and poor service is longer postponed, and the accumulation of necessary reserves involves a smaller tax on the consumer because extended over a longer period.

It follows, therefore, that unlimited franchises, reasonably restricted in their terms and conditions and properly guarded against abuses, will produce the best results for the public, because they will enable the corporations to prosecute their business on a permanent instead of a temporary basis. There is no magic in this result. It is exactly the same as can be predicated of any private business. If one's opportunity to make money is brief, he will make money as fast as he can, without much reference to the future. If, on the other hand, he is in business to stay, and has regard to his future as well as his present financial condition, he builds for the future as well as for the present, and will not be tempted by the prospect of immediate profits to sacrifice either his future financial ability or reputation.

The subjects of Municipal Ownership and of Public Regulation and Control of public utilities are intimately connected with each other. Neither can be adequately discussed without reference to the other. Indeed, one is the alternative of the other. Municipal ownership is demanded largely because of the absence of proper public regulation and control. Public regulation and control, if efficient, removes the necessity or excuse for municipal ownership by securing fair treatment for the public.

If, therefore, a system of public regulation and control, which is at once fair to the corporate interests involved and efficient in securing the results to which the public is equitably entitled, can be evolved and put into operation, municipal ownership can no longer be alleged to be essential to the public interest. What the public wants is efficient and adequate service at fair prices. This is all that could be hoped for from municipal ownership, which, if successful in those particulars, would involve financial risks and political consequences which it is of the highest importance to avoid. Leaving out of consideration those political theorists who adhere to the doctrine that the government should govern as much instead of as little as possible, and that a public official should be substituted for a private citizen whenever and wherever possible, the great body of our people prefer the original American idea, that the functions of government should whenever practicable be restricted rather than enlarged, and that undertakings of an essentially business character are best entrusted to private enterprise rather than to political manipulation. The public funds should be employed solely for public purposes and the tax levy should not be subjected to the perils of commercial enterprises.

But, adhering to these sound tenets, a large body of the public feels itself driven to the more or less favorable consideration of municipal ownership, by the feeling that in no other way less objectionable on general principles can those results to which the public is entitled be obtained. Where private enterprise results only in private gain and not at all or only insufficiently in public advantage, the demand for municipal ownership is natural and inevitable. This fact alone suggests the antidote. If private enterprise results to the public advantage as well as in private gain, the basis for the demand for public ownership is gone.

Assuming, however, as a knowledge of human nature compels us to assume, that a recognition of these fundamental principles can not be expected on the part of all owners of private industries, we are forced to the consideration of measures to compensate for that fact. That which is now uppermost in the public mind is public supervision and control. In the judgment of your committee some form of such supervision and control is inevitable in many if not all of the important states of the Union, and we believe that it should be welcomed by the parties in interest, provided it is put, as we believe it can be, in such form as to preserve the rights and properties of the companies as well as to promote the interests of the public. The practical question is not so much whether there is to be such regulation and control as it is what the nature and form of them are to be. The public demand for it is shown, not only in the pronounced attitude of the President of the United States with respect to interstate railroads, but by the extreme activity of many important state legislatures that are now sitting or have just adjourned. Bills proposing public regulation and control of public service corporations have this year been introduced into the legislatures of at least fourteen states. They deal with the subject in a variety of ways. The diversity of their provisions indicates at once the wide-spread interest in the subject and the merely tentative hold which as yet those dealing with it often have upon the true principles that underlie it.

The most conspicuous of these measures is the so-called Public Utility Bill pending in the legislature of New York as this report is being formulated. As this is likely to be enacted, and may furnish the basis of legislation in other jurisdictions, a brief statement of its essential provisions will be useful.

It provides for two commissions, one for the city of Greater New York and the other for the rest of the state. Each commission is to consist of five members, with salaries of $15,000 each; counsel to the commissioners at $10,000 each; secretaries, experts, accountants, and other employes. The tenure of office of the commissioners is for five years. An initial appropriation of $300,000 is made for the use of the commissioners and for the payment of salaries and disbursements under the act.

All the railroads, street railways, gas and electric companies of the state are placed under the control of the commissioners, who are given the most ample powers for the regulation of rates, the limitation of capital, the requirement of service, and the general supervision of the business and affairs of the companies. The mayor of New York puts the combined capitalization of the companies at $3,322,537,916; their gross earnings at approximately $533,000,000; the number of their employes at upward of 300,000, and the number of their security-holders at not less than 100,000. The powers of the commissioners are alike administrative, judicial and inquisitorial. Practically all the activities of the corporations are subject to their regulation and control. In short, their authority over the interests subjected to their supervision seems to be practically unlimited.

It will thus be seen that, in the most important state of the Union, the theory of public regulation and control of public service corporations is to be put into practice in its integrity and entirety; and, further, that the New York law gives little if any opportunity for the operation of what might be termed automatic or semi-automatic regulation and control; but reposes practically the whole authority in that regard in boards of officials who must necessarily exercise the widest discretion. This act can hardly be said to establish a system of laws and not of men. Everything depends upon the men who shall be clothed with the great authority of applying and administering the law.

Whatever may be the advantages to the public interest attainable by the application and operation of this law under favorable conditions, it can not be denied that it has great opportunities for evil under other conditions. The act reposes in the governor of the state complete powers of removal of the commissioners for cause, and if a time should come when the office of governor should be used for political or personal advantage rather than for the public good, it is manifest that tremendous harm could be done by the removal of desirable and the appointment of undesirable commissioners. Indeed, it is difficult to suggest any other political machine which would be anything like as effective in its operations and as baneful in its consequences. The result might well be to discredit the whole idea of public regulation and control of public service corporations.*

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* Since the above was written the Mayor of the city of New York has exercised his so-called veto power in connection with the bill. saying among other things: "The commissioners are to be appointed by the governor, and as they may be removed by him. or his successors, they will become the direct representatives and agents of each succeeding governor, . . . All members may be of the same political party. What may be will be. And if this bill becomes a law, we may, in the near future, see these commissions composed entirely of political partisans, with great consequent injury to the state and the property affected. The power to regulate rates and fares may be used to destroy. Under given conditions . . . it will be used to influence, coerce and to secure the money with which to currupt the electorate. . . . It is no answer that the present governor will not prostitute his office by the selection of men capable of such acts. . . . The governor's tenure of office is short, and it will not be long before we will have a governor who will not hesitate to use this power."

While an agreement may be reached upon the general principle that public regulation and control of public service corporations is desirable in the public interest, and is not necessarily inimical to the safety and value of corporate investments, it is another and much more difficult matter to agree upon the nature and scope of it. Three systems may be suggested: First, one like the Massachusetts and New York systems, under which everything is practically left to the judicial or quasi-judicial discretion of state officials, clothed with amplest power. Second, a system that, so far as possible, will be automatic or semi-automatic in its operation, through the application of statutory requirements to existing conditions by administrative officials. Third, a system that will be a compromise between, or involve an application in part of the features of both of the foregoing.

In our discussion of this matter we assume the soundness of the economic proposition that the lighting business is essentially non-competitive in its nature; that competition not only involves the duplication of investments and of obstructions in the public ways, but must result in present waste and an ultimate additional burden on the public to compensate therefor. Competitive public utilities of the same nature inevitably result in burdening the service and its customers with duplicate plants, the fixed charges of which more than offset such reductions in rates as may result from competition. Our discussion of the subject now in hand has therefore no application to localities where the soundness of the doctrine which we have stated is not recognized.

Whatever claims of superior efficiency may be advanced in favor of a system of supervision and control of the New York type are offset by the objection of placing the vast interests of stockholders in the keeping, and, as history shows, frequently at the mercy, of public functionaries, who sometimes are, but more frequently are not, fitted by education or experience for the discharge of the delicate duties of their positions. Nothing stands between the companies and the exercise of the unrestrained action of such officials but the guaranties of the federal constitution. But such guaranties only protect against absolute spoliation, and furnish no redress for lesser but almost equally serious injuries which may be inflicted through official action.

One great difficulty under systems of undefined public control is the inability or unwillingness of officials to distinguish between the regulation and the operation of corporations. Regulation should stop where operation begins. Matters of business discretion should be left to the decision of those who are responsible for business results. The directors of the affairs of a corporation undoubtedly, in most instances, are better judges of questions of business expediency than outside officials, however enlightened.

But it is always the tendency of public bodies clothed with judicial powers or official discretion to enlarge their own jurisdiction, and it is not therefore to be expected that they will set proper limits to their authority.

The remedy for this difficulty is to have the obligations of the comporations and the authority of the officials so defined by statute as to make the operation of the provisions of the law upon the state of facts in hand as nearly as possible automatic, calling for the interference of public officials only to the extent of applying the law to the facts as found. The ascertaining of the facts need not, and usually would not, involve to any considerable extent the exercise of discretionary or judicial functions. In short, under such a system the supervisory officials are in the position of a jury, accepting the law directly from the legislature and merely applying it to the facts as found by them.

If the objection is made that such a suggestion needs demonstration of its practicability before it is accepted, the answer is that if the theory is sound it can undoubtedly be worked out in practice, though many details may have to be developed and perfected through experience. But that such a system is practically as well as theoretically sound, is demonstrable through the application of the so-called "sliding scale." This, when once adjusted to the case in hand, will automatically settle the great questions of rates and dividends, to the satisfaction of both the private and public interests involved. The settlement of these two important items — one the most important from the public's point of view, and the other the most important from the corporate point of view — will go far toward removing other difficulties.

The question of original capitalization or increase of capital becomes simplified by the adoption of the sliding scale, because any tendency to overcapitalization will be restrained by the fact that the securities of the company can be made valuable only as and to the extent that rates are reduced. So far as this consideration does not operate to keep the capitalization within proper limits, it is a comparatively simple matter for public officials to decide how much capital is required for a given purpose, and to limit the amount accordingly. They should have nothing to say about the reasonableness of the purpose for which it is wanted, or as to the wisdom of the investment; those are business questions, the decision of which should lie exclusively within the province of those responsible for the business results of the enterprise. The business necessity for capital having been thus determined, the function and authority of public officials should be limited to seeing that the purpose of the issue is a lawful purpose, and that a sinister design to secure an undue inflation of capital is not hidden behind an apparently legitimate purpose on the part of the corporation.

The matter of compulsory supply and of quality of service, although necessarily involving the exercise of more or less discretion, may nevertheless be so carefully provided for by statute as to render the application of the statutory requirements to the facts presented in any given case comparatively simple and easy. Indeed, the questions involved in proceedings for compulsory service are judicial questions, for which the principles of the common law furnish satisfactory solutions. Those principles, supplemented by whatever statutory additions or changes local conditions may seem to require, will be found to furnish an adequate and complete remedy to any one entitled to a remedy. If it is objected that it would involve an undue burden on the private consumer to compel him to seek a private remedy for an evil which the public should deal with, the objection is met by the suggestion that the public official or board charged with the duty of public regulation and control could be required, upon the complaint or application of private consumers, to institute and prosecute the necessary proceedings to secure judicial action.

Even the extension of the territory served by a company and the increase of the availability and adequacy of its service, can be made the subjects of the automatic operation of the theory of the sliding scale. If the company's right to increase of dividends is made to depend, not only on reductions in price, but also upon increase of output — that is, extension of service — it will in its own interests, but with corresponding advantage to the public, seek new customers and encourage more use of its service by present customers. This is entirely possible as a result of a nice application of the theory of the sliding scale, thus removing by one more step the necessity for discretionary regulation and control.

So that, all things considered, it is not necessary to admit that an automatic or semi-automatic system of public regulation and control is impracticable. Its advantages, particularly in delivering vested interests from the perils inseparable from the exercise of more or less arbitrary discretionary powers, are so great that every effort should be made to secure its adoption in practice.

While the foregoing statement embodies the conclusions to which the studies and consideration of your committee have brought it in dealing with this great question of public supervision and control of public service corporations, it nevertheless recognizes the fact that not much has heretofore been said along the lines followed in this report, and that public sentiment may not as yet be ripe for the adoption of a system of the character of that advocated herein.

While further discussion and experience may be necessary for the education of public sentiment along these lines, it is nevertheless desirable that that plan which will ultimately accomplish the best results should be exploited. If in the meantime legislation is to take the form of regulation and control substantially like that embodied in the New York and Massachusetts laws, we desire to go on record as insisting that the administration of such a system or systems shall be entrusted to men of the highest ability and irreproachable character. So much depends — indeed, everything depends — upon the honesty and wisdom of the men clothed with such powers — capable of accomplishing so much good and of doing so much damage to public as well as to private interests — that every effort should be made to obtain them. To that end we would advocate long terms and secure tenure of office, with adequate salaries, sufficient, as far as possible, to remove the element of self-sacrifice in the acceptance and incumbency of the offices.

Inasmuch as in Massachusetts — and perhaps elsewhere — these salaries are assessed upon the corporations, our suggestion of ample compensation for such officials indicates our willingness that, if necessary to obtain the best service, the burden of the adoption of this suggestion shall ultimately be put, in whole or in part, upon the companies in interest.

An important detail in our opinion is that embodied in the New Yor' law — that the term of only one commissioner shall expire at the same time — thus insuring, except for deaths, resignations or removals, a continuous body of experienced men.

We may add that we indulge the hope that, even if the first legislation upon this subject is destined to take the form of non-automatic or discretionary regulation and control, the results of its workings in practice may be the evolution of a highly developed and practicable system of automatic or semi-automatic regulation. We entertain this hope because of our belief in the economic superiority of the one system over the other, and therefore feel justified in believing that ultimately the best will be adopted, even if it is worked out through experience under a less desirable one.

The studies, rulings and declarations of principles by competent commissions should ultimately develop such methods of adjustment of the parallel interests of consumers and corporations as may then be embodied in legislation, operating directly upon the subjects of it, without the necessity of the intervention of officials clothed with a large discretion in its application.

In concluding their report your committee desire to acknowledge their own appreciation of the inadequacy of their work as compared to the possibilities which existing conditions suggest. They have not, however, felt that it was desirable to attempt more than to do as much pioneer work as possible for their successors, by indicating the general principles in accordance with which this work can be best continued.

We believe that the work of the committee is a great work, and should be continued from year to year with all the zeal and wisdom which can be brought to bear upon it. Entertaining as they do the thorough conviction that the interests of the public-service corporations of the country and of the communities which they serve are in truth and in fact identical, they believe these interests will ultimately be shown and acknowledged to be identical. The energies of this committee and of this association should be bent toward bringing about such relations between the public and private interests involved as will demonstrate the soundness of the conclusion above stated.

Respectfully submitted,

EVERETT W. BURDETT, *Chairman,*
HENRY L. DOHERTY,
ALEX DOW,
CHARLES L. EDGAR,
SAMUEL INSULL,
J. W. LIEB, JR.,
JOSEPH B. MCCALL,
SAMUEL SCOVIL,
W. H. GARDINER, *Secretary,*
*Committee.*

## REPORT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION SUB-COMMITTEE ON MUNICIPAL OWNERSHIP.

(June, 1907.)

*To the Committee on Public Policy, National Electric Light Association:*

The sub-committee on Municipal Ownership has received during the year only one inquiry from a member for specific information. This inquiry came from a Texas member company and related to a municipal plant located in Missouri. The sub-committee was able to furnish the information requested. In addition to this specific inquiry a number of general inquiries, which could be answered by reference to publications or by the forwarding of printed matter on file in the office of the association, have been dealt with directly by the assistant secretary of the association.

The sub-committee has not thought it necessary to ask for reports from all member companies, but has kept itself generally advised as to municipal ownership of electric-lighting p'ants and has studied with care several instances that appeared to be of more than usual interest. From the general information received and from these special studies, the sub-committee is of opinion that during the twelve months since the last convention municipal ownership of electric-lighting plants in the United States has been stationary, with a marked tendency to retrogression. We do not feel warranted in saying that there is an actual recession in the municipal ownership of electric lighting properties. Our opinion is that the propaganda in favor of such ownership is losing its vitality and that actual retrogression may be expected to follow.

To a large extent this decadence of the municipal ownership idea is due to the rapidly approaching culmination of the idea of public regulation. These two ideas are alternatives. The acceptance of the idea that certain public services can be practically and equitably regulated by the municipality, or the state, or the nation, involves the abandonment of the earlier popular idea that municipal ownership of such services was the only way in which good service could be secured at reasonable rates. The socialistic element of our population, setting up ownership and operation of all public services as an ideal, does not accept public regulation as a substitute for public ownership, but only as a step toward that goal. In fact, some socialistic teachers object to regulation as tending to postpone ownership. (See the articles by Professor Frank Parsons in the Boston *American* during the winter of 1905-6, criticizing the Massachusetts state system of regulation.) But the general mass of our citizenship seeks, as an end, merely good service at reasonable rates and has no prejudice regarding the means by which this end shall be attained. It is to this general mass that the arguments of the parties to any contest must be addressed and it is by their votes that all such questions must be decided. At the present time it appears to us that the majority of voters are minded to give a trial to public regulation as a remedy for grievances from which they suffer, or think they suffer, and that municipal ownership is temporarily forgotten. We think it necessary to repeat and accent this statement. Municipal ownership is not discredited; it is merely forgotten. It would be a serious error to assume that the present movement of public sentiment toward public regulation signifies that municipal ownership is now or is soon going to be consigned to the limbo of discredited theories, along with such past crazes as free coinage of silver at a ratio of 16 to 1. If public regulation shall fail to establish a good understanding between the corporations operating public utilities and the customers of those corporations, we shall inevitably have a revival of the cry for municipal ownership.

The most valuable lessons to be taught by the municipal ownership history of the past twelve months are drawn from contests and campaigns in which electric lighting was not the leading or immediate issue, namely, the campaigns leading up to the London, England, county council elections on Saturday, March 2, 1907; the Chicago mayoralty election and street railway ordinance vote on Tuesday, April 2, 1907; and a few contests of less general interest, to be mentioned later herein. These important lessons appear to us to be as follows:

*First* — There remains in the mind of the average voter a prejudice against public service corporations, causing him to believe such corporations guilty of any charge brought against them until they are shown to be innocent.

The difficulty of getting a fair jury when a corporation is a party to a trial is so well known that I need not present any proof. The voter at an election should weigh the evidence before him exactly as if he were a juryman at a trial. Unfortunately, a prejudiced voter can not be disqualified for prejudice.

*Second* — The recent elections, particularly those in London and Chicago, show that the initial prejudice of the voter may be overcome.

It is being freely said by the proponents of municipal ownership that the issue in London was not municipal ownership, but was high taxation due to street openings, and so forth. (See *Everybody's Magazine* for May, page 718, where Mr. Charles Edward Russell says this.) The proof to the contrary is very complete. Visitors to the National Electric Light Association convention in Washington will find on a table a scrap book containing an assortment of the printed matter distributed by both parties in the London contest, which, without other evidence, will prove that municipal ownership — or, as it is called in England, municipal trading — was the dominant issue. If any doubt remains, the statement of Sir William Treloar, lord mayor of London, speaking at the London automobile show on March 7, should settle that doubt. He said: "I believe this election was gained not at all, or very slightly, on political lines. It was a protest of the electors against municipal trading." The London *Times* of February 27, before the election, states that a committee of the London Chamber of Commerce invited all the reform candidates — that is to say, the candidates of the party that was successful — to state whether or not they were opposed to municipal trading and whether, if elected, they would do what they could to oppose the system. Out of 118 candidates 84 replied unconditionally in the affirmative to both questions, and the *Times* adds that in nearly every case the candidates in their addresses absolutely condemned competition with private enterprises.

As to the Chicago election, at which the issue was municipal or company ownership of street railways, it appears to us that the decisive factor in the contest was the frank disbelief of the general voting population in the ability of the municipal government to give good transportation service and the equally frank acceptance of the idea that a corporation reasonably capitalized and reasonably controlled could and would give the service required. This conclusion in the home of the largest municipal lighting plant in the United States proves that municipal ownership is not dear as an ideal to the heart of the American citizen. He looks upon it merely as a means to an end and accepts it only when it appears to be the only means readily available. A brief statement of the Chicago issues and campaign will be found in the last paragraph of this report.

*Third* — But when the issue to be voted upon is a question of public service and an intelligent vote is desired, the individual voter must be reached by presentations of fact and argument that apply to his individual case.

It is not sufficient to present an academic discussion of the question in the editorial columns of newspapers. It is not sufficient to distribute general statements of the issue by mail to the registered voters. It is not even sufficient to hold local or district meetings to discuss the issue. The object must be analyzed and its relations to each class (however small) of the voting citizenship clearly defined; and that part of the analysis that applies to the case of each voter must be got into the hands and into the mind of that voter.

The foregoing program is a large one. Nevertheless, it is the only program that leads to success. It is not a new program. It has already been followed to the letter, and with success. The denunciation of corporations by professional politicians and agitators, by devotees of the socialistic cult, and by well-meaning students of social conditions, has never ceased and has in recent years become so voluminous and so able as to have an effect on the mind of every citizen. The general reader of press and magazine articles and the listener to socialistic addresses from platform or pulpit do not always accept what they are told as gospel, but do always receive the impression that where there is so much smoke there must be some fire. And the individual who finds it hard to make a living is quick to accept a theory that charges to corporate greed the origin of his evil circumstances. When, to voters prejudiced by such impressions and beliefs, a scheme of public ownership is proposed, with promises of reduced cost of service, reduced taxes, and plenty of jobs for deserving citizens, it takes a strong showing of personal advantage to secure votes against the proposal. The printed matter used in the London campaign is an excellent illustration of such personal argument. The references to increased rentals due to increased taxes on household premises; to idleness of workmen because former employers had been taxed out of the municipality; to lost trade and bad debts of small shopkeepers because their customers, being idle, had no means wherewith to buy or pay — these were lessons that found apt scholars. In Chicago the object lessons of bad street railway service getting daily worse while politicians debated "immediate municipal ownership," and districts without service because capital declined to make investments subject to summary confiscation — these lessons reached every voter. In an earlier successful campaign against municipal ownership — that in Cleveland in 1902 against the proposal to engage the city in the electric light business — effective work was done by showing foreign-born voters, by circulars printed in their mother tongue, that the taxes on their much-prized homesteads would be increased in order to reduce the cost of something that to their frugal minds appeared to be a luxury.

The Chicago "Immediate Municipal Ownership" campaign, although electric lighting was not the direct issue, is of such value as an illustration of the present temper of the public that we think it well to present a brief statement of its issue and history as a conclusion to this report.

In Chicago events would indicate that the crest of the wave or craze for municipal ownership has been passed, and that this crest occurred with the nomination of Mr. Edward F. Dunne for mayor of Chicago, in the spring of 1905, on an immediate municipal ownership platform; also with the passing on the part of the legislature of the state of Illinois of a bill providing for the issuance of certificates known as Mueller certificates, proceeds from the sale of which were to be used by the city of Chicago in the purchase of street railroads and equipment for a municipal traction system. At that time the long period of discussion and legal fighting that attended the closing years of the principal franchises of the street railway companies had culminated in the failure of the traction corporations to come to any terms with the city in the matter of extension of rights and in the actual termination of said principal franchises. During this period of suspense and agitation the street railway properties had been allowed to run down and the equipment and service had become, to say the least, extremely unsatisfactory. This was no more than might naturally have been expected, as the owners of the traction securities could hardly be blamed for declining to put up more money and authorize heavy expenditures for improvements when the leaders of large bodies of people were openly advocating the practical confiscation of their property.

A long-suffering public, not well informed and not having had an opportunity to thoroughly masticate the subject, was anxious to support anything that seemed to promise the quickest amelioration of the existing conditions, and Mr. Dunne, backed by a good record as a judge and promising immediate municipal ownership with greatly improved service, was elected by a majority of approximately 40,000 votes. A few months, however, satisfied the most unthinking of the people that not only was it impossible to institute municipal ownership immediately, even if authority and means had been immediately available, but that the legal rights of the traction companies must be settled, in the courts if necessary, whether the people wished it or not; the issuing of Mueller certificates for the purchase of the roads must be submitted to the people at a regular election, and, furthermore, these voters had begun to realize that perhaps municipal ownership was, after all, not what they wanted.

A year passed, and the questions above were submitted to the people. The right to issue Mueller certificates was given by so slender a majority that it was looked upon by those opposed to municipal ownership as a practical defeat of the scheme, and the proposition to permit the municipality to operate the roads was decisively lost. A short period of education followed, and a committee of the city council appointed to confer with the railroads, and if possible submit some plan for the solving of the problem, finally gave evidence that there seemed to be a common ground on which the people and the street railways could come together. This took form in an ordinance which established a value upon the properties of the street railways, promised them reasonable franchises and an opportunity to obtain a fair return on the new capital to be invested, insured the city very fair compensation in exchange for the franchises, and arranged a plan by which the service should be promptly improved and the city should have proper control of the action of the companies. This ordinance was introduced and passed by a large majority of the city council. It, however, did not meet with the approval of Mayor Dunne, who vetoed it, and it was thereupon passed over the mayor's veto. Then the municipal ownership party secured within the time limit a sufficient number of signatures to require its submission to the vote of the people. The approval of the ordinance was the principal plank in the platform of the republican candidate and the contest aroused the interest of the people. The action of the city council in passing the ordinance was indorsed by a majority of 33,000 and the republican candidate was, while running somewhat behind the vote on the traction ordinance, elected by a majority of 13,000 votes, the first republican mayor to be elected by the people within a period of nearly twenty years.

One can only speculate as to the exact analysis of this vote, but the general feeling is that, in view of the democratic tendency of the city and the strength of the democratic organization, it represented very much more of a revulsion of feeling on the part of the general public in the matter of municipal ownership than the figures would indicate. In other words, that an overwhelming percentage of the right-thinking and intelligent element of the community, which represents the balance of power, had after mature consideration come to the conclusion that private ownership, under proper conditions as to regulation, would be very much more satisfactory to the public and to the general interests of the municipality and its citizens than would municipal ownership.

As to the Mueller certificates, there has, since their authorization by legislative enactment and by the indorsement of the people, been much speculation as to their legality, and also, in financial circles, as to the city's ability to put them out on any warrantable basis or so to invest the city with any substantial amount of the face value that they represent, but this speculation has been brought to an abrupt close by action of the Supreme Court of Illinois, in a decision handed down in April, 1907, holding that most of the essential features of the act are illegal and indicating that, while there may be a possibility of curing them, it can not be done in a way that will leave the law effective for the purpose intended. In fact, the decision is sweeping and is looked upon by all intelligent people as an absolute death-blow to the city's ambition to sometime own the street railways.

Respectfully submitted,

ALEX DOW, *Chairman,*
SAMUEL INSULL,
*Sub-committee.*

## REPORT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION SUB-COMMITTEE ON PUBLIC REGULATIONS AND CONTROL.

(June, 1907.)

*To the Committee on Public Policy, National Electric Light Association:*

The report of the secretary of the Committee on Public Policy in reference to measures introduced in the various state legislatures that have been in session this winter, indicates that there has been a variety of measures introduced in almost all of these legislative bodies affecting public service corporations.

This proposed legislation, where unfriendly, is not solely the result of antagonism to the municipal public utility companies, but is undoubtedly prompted in no slight degree by the agitation for a more strict control and regulation of the steam railroads.

The movement is a natural one in itself. Regulation by force of competition, potential or actual, has been the policy of all states from the time public utilities were first developed to the present day. This method of regulation required secrecy of accounting on the part of public utility corporations. No corporation could justly be required to expose its accounts to a competitor. This condition prevented the public from obtaining accurate knowledge of facts necessary to the formation of an intelligent public opinion.

To secure relief and immunity from the evils of regulation by competition, public opinion has been led to demand a policy of state regulation or of municipal ownership. State regulation, if it is to be intelligent, must have the means of securing an accurate knowledge of facts. This requires the substitution of public accounting for secrecy of accounting. This change requires the abandonment of the policy of competition. Public utility corporations must be given protection in their business in consideration of their giving full information to the public regarding their accounts.

In view of these facts, the wise course would seem to consist, not in an attempt to stem the tide of public opinion, but rather in seeking to evolve and define that method of public supervision and measure of control which will permit of the attainment of the maximum efficiency of operation and thus give to users the service they require at the least possible cost to them and at the same time allow such fair and commensurate returns upon the capital required that it can be readily provided, to the end that the companies shall conduct their business in the most progressive and enterprising manner.

Your committee is of the opinion that the National Electric Light Association should take the position that it is in favor of a proper system of regulation by properly-constituted authorities, provided that hand in hand with the regulation shall go proper and adequate protection for the capital investment in these corporations. This means that the regulating authority, wherever it is vested, shall be vested in such a body that the individuals comprising it shall be assured of a fixed tenure of position, so as to be free from dictation from any political source as well as from the pressure of any local sentiment which might prevent them from dealing with all interests concerned with justice.

If commissions be constituted they should receive their appointment directly from the state authorities, and the terms of the members thereof should be for lengthy and fixed periods of time, their tenure of office expiring at different dates.

Each lawgiving power of regulation should contain within itself a clearly-stated rule by which the reasonableness of the regulation shall be determined. Such a rule enacted in the law will go very far toward removing all causes of difference of opinion between public utility corporations and state commissions, as both parties will be equally capable of determining for themselves whether or not their own act as a corporation, or their own order as a commission, will stand the test of reasonableness by the application of the rule. Beyond this, should the two parties be unable to agree and appeal to the courts, the decision of the courts would necessarily be rendered according to the law, and thus the legal rule for determining the reasonableness of an act would receive judicial construction that would be acknowledged to be final and binding upon both parties. It is as necessary that laws giving powers to such commissions shall define and regulate their actions as it is that they shall define and regulate the action of public utility corporations. Evils that in the past may have resulted from permitting public utility corporations to be the sole judges of the reasonableness of their own acts will result from creating state commissions to carry into effect a state policy of public regulation and making such a commission the sole judge of the reasonableness of its own acts.

The duties required of any commission in properly regulating and supervising the operation of public utility companies are such that a knowledge of the conditions that the public utility companies have to meet is absolutely necessary. Individuals who find themselves suddenly intrusted with power should not proceed to exercise it rashly or hastily, or according to some preconceived notion. They should first familiarize themselves with the business that they are empowered to regulate.

There is a community of interest between the public served and the corporation serving it. The regulating body's goal should be to see that happy medium as to prices charged and return upon capital arrived at which will result in maximum benefits in the way of services.

Your committee believes that it should be impressed upon the officials controlling public utility corporations that the public will is that these companies shall exist, not primarily to make dividends upon certain investments of capital, but as the most efficient means of supplying the public's needs. Every effort should be made to have the public fully understand and appreciate the fact that, in order to secure the maximum benefits from any corporation that it authorizes to furnish it with a service it needs, it must permit this corporation to receive an ample return upon the investment, which return upon its investment must be commensurate with the risk assumed, and that the risk assumed in the electric light and power business has in it most of the elements of a manufacturing risk.

We desire specifically to point out that all the burden of expense imposed by special regulations and special taxes upon the public utility company are additional burdens thrown upon its service and paid for by its consumers. The interest of the consumer in our industry is directly and primarily in the price at which we furnish adequate service, and such special taxes must necessarily impose upon the consumer an unjust proportion of the burden of taxation.

### CONCLUSION.

The sub-committee's conclusions are:

*First* — That the National Electric Light Association should favor properly-constituted general supervision and regulation of the electric light industry.

*Second* — That if state commissions be constituted they should be appointed in that manner which will give them the greatest freedom from local and political influences, to the end that their rulings shall be without bias.

*Third* — That state commissions should be clothed with ample powers to control the granting of franchises, to protect users of service against unreasonable charges or improper discriminations, to enforce a uniform system of accounting and to provide for publicity. If the state provides for publicity on the one hand, on the other hand it should safeguard investments. Regulation and publicity would be a grevious wrong unless accompanied by protection.

In the conferring of these powers, great care should be taken. Regulation in and of itself necessarily introduces a factor of resistence to the adoption of new methods and to progress generally. Hence in the interest of lower costs, and consequent lower charges to users of service, the functions of the commissions should be confined within strictly regulative lines.

Respectfully submitted,
SAMUEL SCOVIL, *Chairman,*
JOSEPH B. MCCALL,
*Sub-committee.*

VICE-PRESIDENT SHAW :— The next order of business is the report of the Nominating Committee. The chairman, Mr. W. Caryl Ely, will present the report.

## REPORT OF THE NOMINATING COMMITTEE.

*To the American Street and Interurban Railway Association.*

Gentlemen:—The Nominating Committee presents an entirely unanimous report and suggests for your action the names of the following gentlemen for election to the respective offices in this association:

For President—Calvin G. Goodrich, of Minneapolis.

For 1st Vice-President—James F. Shaw, of Boston.

For 2d Vice-President—Arthur W. Brady, of Anderson, Ind.

For 3d Vice-President—Thomas N. McCarter, of Newark, N. J.

For Members of the Executive Committee—The President, Vice-Presidents, and Frank R. Henry, of St. Louis, President of the Accountants' Association; Fred. G. Simmons, of Milwaukee, President of the Engineering Association; H. R. Goshorn, of Philadelphia, President of the Claim Agents' Association.

Respectfully submitted,
W. Caryl Ely, *Chairman,*
C. S. Sergeant,
A. E. Lang,
*Committee on Nominations.*

Mr. Ely:—I would like to say in connection with the report of the Nominating Committee, but not with the intention of drawing distinctions between men so far as degrees of excellence are concerned, that Mr. Goodrich, who has been such a busy man, and as you all know probably the chief instrument in building up the great system which is pictured here before us, certainly honors the association in consenting, under all the circumstances and after the most frank talk with some of the members of the Nominating Committee, in which he showed a keen realization on his part of the burden of labor involved in assuming the presidency. That Mr. Shaw, of Boston, who is a very busy man, should be willing to serve in the capacity of first vice-president with the idea that he will work and labor; that Mr. Arthur W. Brady, of Anderson, Ind., should feel in that way; that the Honorable Thomas N.

McCarter, who has occupied the very distinguished position of Attorney General of New Jersey, in the discharge of the duties of which office he accentuated his abilities to such an extent that his name has become a public name throughout the country, and who now occupies the position of president of the Public Service Railway Company, that he should be willing to come in and express himself as he has to the chairman of the Nominating Committee and that he would be glad to undertake any service on behalf of this association; all these things ought to make the members of the association who know of them and who are participating in these meetings feel satisfied that we are making progress upward and not downward.

VICE-PRESIDENT SHAW:— What is the pleasure of the convention on the report of the Nominating Committee?

MR. HARRIES:— I move the adoption of the report and that the secretary cast a ballot for the officers named.

(Motion carried.)

VICE-PRESIDENT SHAW:— The secretary announces he has cast a ballot as directed, and the gentlemen are declared elected.

The next business will be the report of the Committee on Resolutions, which will be presented by Mr. Davies, of Cleveland, who is a member of the committee.

## REPORT OF COMMITTEE ON RESOLUTIONS.

*To the American Street and Interurban Railway Association:*

GENTLEMEN: — Your Committee on Resolutions begs to submit the following report:

I. WHEREAS, The American Street and Interurban Railway Manufacturers' Association has assembled and placed for examination a very complete, excellent and interesting exhibit of railway appliances for the inspection of the members of this association; and

WHEREAS, The arrangement of the exhibits with respect to artistic effects as well as with regard to convenience and facility for examining them gives evidence of the most careful and painstaking thought; and

WHEREAS, The social and entertainment features provided by the American Street and Interurban Railway Manufacturers' Association have been most carefully planned and carried out,

*Now, therefore, be it Resolved,* That the American Street and Interurban Railway Association place on record its appreciation and thanks to the American Street and Interurban Railway Manufacturers' Association, its officers, executive committee and its members collectively and individually, for their energetic and tireless efforts in producing these most successful results.

II. WHEREAS, The members and guests of the American Street and Interurban Railway Association are under very great obligations to the mayor of Atlantic City, the Atlantic City Business Men's Association, the Atlantic City Hotel Men's Association, the Atlantic City Bureau of Publicity, the telephone and telegraph companies and the technical and local press, for numberless courtesies and attention, including facilities for exhibiting street railway materials and appliances and other privileges and attentions,

*Now, therefore, be it Resolved,* That the thankful acknowledgments of this association be tendered therefor.

III. *Resolved,* Also, that the association is indebted to its officers for their faithful work during the year, to the authors of the papers that have been read and to the standing and special committees of the association for their carefully prepared and valuable reports.

Respectfully submitted,
C. D. WYMAN, *Chairman.*
C. S. SERGEANT,
H. J. DAVIES,
*Committee on Resolutions.*

VICE-PRESIDENT SHAW:— Gentlemen, you have heard the report of the Committee on Resolutions. What action will you take in regard to it?

MR. LANG:— I move that the report be adopted.

(Motion carried.)

MR. ELY:— Mr. President, I have a resolution which is the outcome of the discussion at the executive session held yesterday afternoon, at the end of which this resolution was directed to be prepared as receiving the unanimous sanction of the meeting:

"WHEREAS, Experience has demonstrated the desirability and usefulness of our existing affiliated organizations; and

"WHEREAS, It has appeared from discussion that another organization of similar character should be created, to which should be committed lines of work pertaining to transportation, traffic and general operation,

"*Now, therefore, be it Resolved,* That the executive committee be and hereby is requested to take such steps as it may deem desirable to encourage the formation of such an organization."

Under the circumstances and the time being short, the fact being as I stated that this has received the unanimous approval of the executive session of yesterday, and inasmuch as the resolution is self-explanatory to a very great extent, I have no remarks to make and therefor move the adoption of the resolution.

(The resolution was unanimously adopted.)

VICE-PRESIDENT SHAW:— Mr. L. T. Peck, of the Honolulu Street Railway Company, is present, and I believe he has some interesting information regarding the correction of the abuse of transfer privileges, which may be of value to the members of the association.

MR. PECK:— I do not want to take up any time of the convention in this matter, but I thought perhaps a few of the members might have some such problems as we have had in Honolulu with transfers, and that you might be interested in knowing what we have done there to checkmate some of the abuses of the transfer system. Under our franchise we had a provision that for one fare a passenger could go from any point on the system to any other point on the system. He was not compelled to take the shortest route, neither could the company select the route for the passenger. The result of this law was that we had a number of abuses of the transfer privileges. We have a number of parallel lines with cross lines intersecting them, and we soon found that by the use of the ordinary transfer system we had a great deal of around-the-circle riding, a great many people who for one fare would go down town and attend to their business and come back on a transfer.

After standing several lawsuits, and being worsted every time, and losing a great deal of money for suits for the ejectment of passengers, apparently circle riders on our cars, we adopted a through transfer. That is, when the passenger pays his fare we give him a transfer which he keeps to the end of the journey. It not only identifies the line on which his journey originated, but also identifies the zone of the line on which his journey originated. On line No. 1, if a passenger gets on between zone A and zone B, it is punched on the ticket to show that he got on line No. 1 between zone A and zone B. The passenger holds this ticket and he can go in a certain direction, but, if he attempts to get back to his starting point, when he presents his original transfer ticket to the conductor of the original line, the conductor sees not only a transfer ticket punched for his own line, but a transfer ticket in which the zone on the line is marked, showing the beginning of the passenger's journey. If he comes back to some point on that zone, he cannot go through, the courts having held that to go over the same identical rails in either direction a second time constitutes an attempted fraud on the corporation. Therefore, we punch the zone in which the journey originates, and the passenger may transfer from line to line on his original identification transfer slip, but he cannot go back over the line on which the journey originated, or pass the zone, on this transfer. We have used this system for two years and we have not had any abuse of it that has not been detected and prevented.

(President Beggs in the chair.)

President Beggs:— You have heard me a great deal during the last two or three years, and there may be some gentlemen who feel it a relief to know that he who has been president of your association for the past twelve months and who has been one of the co-laborers in the interests of the association with others who have given careful thought and earnest continuous work to bring this association to its present condition, will not burden you hereafter with so many talks from the president.

I do, however, desire to sincerely and heartily thank the entire membership, not only the American Street and Interurban Railway Association, but likewise the Accountants' Association, the Engineering Association, the Claim Agents' Association, and last, but by no means least, the American Street and Interurban Railway Manufacturers' Association, for their uniform courtesy and consideration during my term as president, and I could not bespeak for the new officers and executive committee greater consideration, or give them greater assurance of the continued successful administration of the affairs of the association than to be able to assure them, which I feel warranted in doing, of that continued and united support from these various affiliated associations which are from year to year becoming, in my judgment, more important. I therefore again say I thank you. I shall always look back — the chances are it is not for many years — I shall always look back, as one of the greatest honors I have received in the street railway business, to my year's administration as president of this association. I desire to pledge without reservation or qualification to the incoming officers and executive committee of this and the affiliated associations, just as earnest work as I have given in the past, notwithstanding I will not have the same degree of responsibility. I thank you, gentlemen.

On motion, the convention adjourned, *sine die*.

# CONSTITUTION AND BY-LAWS

OF THE

# AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.

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## *CONSTITUTION.*

### NAME AND LOCATION.

I. a. The name of the Association shall be the "American Street and Interurban Railway Association."

b. The headquarters of the Association shall be located in the City of New York.

### OBJECTS.

II. The objects of the Association shall be as follows:

a. The discussion and recommendation of methods of construction, management and operation of street and interurban railways, and of safeguarding the interests of the same.

b. The establishment and maintenance of a spirit of co-operation among the members, and the encouragement of friendly relations between the companies and the public.

c. The acquisition of experimental, statistical and scientific knowledge relating to the construction, equipment and operation of street and interurban railways and the diffusion of this knowledge among the members.

### MEMBERS.

III. The membership of this Association shall consist of two classes as follows:

a. Active Members, consisting of American street and interurban railway companies, or lessees, or individual owners of street and interurban railways. Each member shall be entitled to one vote, which shall be cast by the properly accredited delegate.

b. Associate Members, consisting of individuals, co-partnerships and corporations, who are actively identified with street and interurban railway interests, and other persons who in the opinion of the Executive Committee have had experience of such a nature as to render desirable their connection with the Association. The privileges of the associate members shall be similar to those of the active members excepting that they shall not be entitled to vote or hold office, nor shall they have the privileges of the floor unless permitted by the Association.

### AMENDMENTS.

IV. This Constitution may be amended by a two-thirds vote of the members present at a regular meeting, provided the proposed amendment shall have the approval of two-thirds of the Executive Committee, and provided that a copy shall have been sent to each of the active members at least thirty days prior to the date of the meeting at which the proposed amendment is to be acted upon.

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## *BY-LAWS.*

### ELECTION OF MEMBERS.

I. Every applicant shall signify his desire to the Secretary, enclosing the requisite fee. All applications for membership shall be referred to the Executive Committee, a two-thirds vote of the members of the Executive Committee by ballot being necessary to election. In case of rejection the membership fee shall be returned. The Executive Committee shall report at each meeting the names of new members elected.

### OFFICERS.

II. a. The officers shall consist of a President, Vice-Presidents equal in number to the number of affiliated associations, a Treasurer and a Secretary. The officers shall assume their duties immediately after the meeting at which they are elected.

b. The President and Vice-Presidents of the Association shall be elected at the Annual Meeting of the Association. All such elections shall be by ballot, and a majority of the votes of all the members present shall be necessary to an election. The Secretary and Treasurer shall be appointed by the Executive Committee. The offices of Secretary and Treasurer may be held by one and the same person; and the work of the Treasurer's office shall be performed in the Secretary's office.

### PRESIDENT AND VICE-PRESIDENTS.

III. The President shall be the chief executive officer of the Association. He shall preside at the meetings of the Association and of the Executive Committee. In the absence of the President any duties devolving upon him may be performed by one of the Vice-Presidents.

### TREASURER.

IV. The duties of the Treasurer shall be to receive, safely keep and account for all moneys of the Association; to keep correct accounts of the same, and to pay all bills approved by the President. He shall make an annual report to be submitted to the Association. He shall give a bond to the President in such sum, and with such sureties, as shall be approved by the Executive Committee. He shall be paid a salary fixed by the Executive Committee.

### SECRETARY.

V. The duties of the Secretary be as follows:

a. To take minutes of all proceedings of the Association and of the Executive Committee and to enter them in books proper for the purpose.

b. To conduct the correspondence of the Association.

c. To read minutes and notices at all meetings and to present papers and communications if the authors wish it.

d. To collect and file for the benefit of the members information and statistics regarding matters relating to the purposes of the Association.

e. To receive applications for membership and to lay such before the Executive Committee.

f. To attend to the publication of the proceedings of this Association; and, in conjunction with the Secretaries of the affiliated associations, to the publication of the proceedings of such affiliated associations.

g. To send notices to all members of the Association at least thirty days before each meeting, mentioning papers to be read and any special business to be brought before the meeting.

h. To perform such other duties as may be required of him by the Constitution and By-Laws, and such duties as may be assigned him by the Executive Committee.

The office of the Secretary shall be maintained at the headquarters of the Association. He shall be paid a salary fixed by the Executive Committee.

### THE EXECUTIVE COMMITTEE.

VI. a. The entire charge and management of the affairs of the Association shall be in the hands of an Executive Committee, which shall consist of the President, the Vice-Presidents, and one member appointed by each of the affiliated associations. The Executive Committee shall make arrangements for carrying out the objects of the Association.*

b. The Executive Committee shall hold a regular meeting before each regular annual meeting of the Association, and shall hold such special meetings as may be necessary. Such special meetings may be called by the President or by any five members of the Executive Committee. A majority of the members of the Executive Committee shall constitute a quorum at all meetings.

The Secretary shall give such reasonable notice of all meetings as the committee shall by vote prescribe, and all such notices shall, as far as practicable, specify the business to be brought to the attention of the committee at such meetings.

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* **For amendment to this paragraph, adopted at the 1907 convention, see page 321.**

c. The Executive Committee may assign to its allied association, the American Street and Interurban Railway Manufacturers' Association, the management of the exhibit features of the annual conventions, and it may arrange with the said Manufacturers' Association the details of such entertainments as may be given in connection with the annual conventions of this Association.

d. The Executive Committee shall present a report to each regular annual meeting of the Association, and shall include in such report the names of members elected during the year, and its recommendations for the future work of the Association.

## MEETINGS.

VII. a. Regular annual meetings of the Association shall be held at such time between the fifteenth day of September and the fifteenth day of December, in each year, as the Executive Committee may decide to be best suited to the locality in which the meeting is to be held; the time to be decided upon and each member notified of the selection by the first day of May in the year in which the meeting is to be held. Special meetings may be held upon the order of the Executive Committee. Notice of every meeting shall be given by the Secretary, in a circular addressed to each member, at least thirty days before the time of the meeting. Fifteen members shall constitute a quorum at any meeting.

b. At all meetings of the Association discussion shall be limited to active members; provided, however, that special privileges may be accorded others at the will of the meeting.

c. At any regular or special meeting, executive sessions may be held. Such sessions shall be open to active members only.

## ORDER OF BUSINESS.

VIII. The regular order of business shall be:

1. Reading of minutes of last meeting.
2. Report of the Executive Committee.
3. Address of the President.
4. Report of the Treasurer.
5. Reports of Standing Committees.
6. Reports of Special Committees.
7. Reports from Affiliated Associations.
8. Reading and discussion of papers.
9. General business.
10. Election of officers.

## COMMITTEE OF SUBJECTS.

IX. In order to secure continuity of work and uniformity of general purpose, a Committee on Subjects shall be appointed each year by the

Executive Committee. The function of this committee shall be to suggest topics for the work of the American Street and Interurban Railway Association and its affiliated associations for each year in advance.

The committee shall consist of one member from each of the affiliated associations and a number from the American Street and Interurban Railway Association equal to the total number from the affiliated associations. The committee, at each annual meeting, shall present its plans for the coming year.

### VOTING.

X. All votes except as herein otherwise provided, shall be *viva voce*; and in case of a tie, the presiding officer shall vote.

### READING OF PAPERS.

XI. All papers read at the meetings of the Association must relate to matters connected with the objects of the Association and must have been previously approved by the Executive Committee.

### AFFILIATED ASSOCIATIONS.

XII. This Association shall do all in its power to promote the welfare of other associations organized with its approval to investigate technical matters connected with street and interurban railway construction and operation. To this end it will, in the following ways, and in others which may be determined by the Executive Committee, assist in the work of such affiliated associations:

a. By authorizing the formation and approving the constitutions of such associations.

b. By admitting to the Executive Committee a member from each of such associations.

c. By granting financial assistance to such associations.

d. By editing, printing and binding the reports of the proceedings of such associations.

e. Through its Secretary and Executive Committee it will assist in arranging for conventions, suggesting suitable subjects for investigation; it will file information for reference and distribution and in every way endeavor to stimulate interest in all of the affiliated associations.

### PAPERS, DRAWINGS, ETC.

XIII. All papers, drawings and models submitted to the meetings of the Association shall remain the property of the owners; subject, however, to retention by the Executive Committee for examination and use, but at the owner's risk.

### FEES.

XIV. Active members shall pay an admission fee of ten dollars and annual dues payable in advance based on gross earnings from railway operation during the preceding fiscal year of the respective companies as follows:

| | Gross Receipts. | | | Annual dues. |
|---|---|---|---|---|
| Under | $50,000 | | | $15 00 |
| Between | 50,000 | and | $100,000 | 25 00 |
| " | 100,000 | " | 250,000 | 50 00 |
| " | 250,000 | " | 500,000 | 75 00 |
| " | 500,000 | " | 1,000,000 | 100 00 |
| " | 1,000,000 | " | 2,000,000 | 150 00 |
| " | 2,000,000 | " | 3,000,000 | 200 00 |
| " | 3,000,000 | " | 4,000,000 | 250 00 |
| " | 4,000,000 | " | 5,000,000 | 300 00 |
| " | 5,000,000 | " | 6,000,000 | 350 00 |
| " | 6,000,000 | " | 7,000,000 | 400 00 |
| " | 7,000,000 | " | 8,000,000 | 450 00 |
| " | 8,000,000 | " | 9,000,000 | 500 00 |
| " | 9,000,000 | " | 10,000,000 | 550 00 |
| | 10,000,000 | " | over | 600 00 |

Associate members shall pay in advance an annual fee of five dollars.

### ARREARS.

XV. No member whose annual payment shall be in arrears shall be entitled to vote.

### WITHDRAWAL.

XVI. Any member may retire from membership by giving written notice to that effect to the Secretary, and the payment of all annual dues to that date, but shall remain a member and liable to the payment of annual dues until such payments are made, except as hereinafter provided.

### EXPULSION.

XVII. A member may be expelled from the Association by the vote of two-thirds of the members present at any regular meeting of the Association, upon the written recommendation of the Executive Committee.

### RULES OF ORDER.

XVIII. All rules not provided for in these By-Laws shall be those found in Roberts' Rules of Order.

### AMENDMENTS.

XIX. All propositions for adding to or altering any of these By-Laws shall be laid before the Executive Committee, which shall bring them before the next regular meeting of the Association, if it shall consider such course desirable; and it shall be the duty of the Committee to do so, on the request, in writing, of any five members of the Association.

### AMENDMENT TO THE BY-LAWS.

(Adopted at 1907 convention.)

VI. a. The entire charge and management of the affairs of the Association shall be in the hands of an Executive Committee, which shall consist of the President, the Vice-Presidents and one member appointed by each of the affiliated associations; and all the Past Presidents of the American Street and Interurban Railway Association and its predecessor, the American Street Railway Association, these Past Presidents to be honorary members of the Executive Committee, but without the power to vote at meetings of the committee. The Executive Committee shall make arrangements for carrying out the objects of the Association.

## MEMBER COMPANIES AND THEIR OFFICERS.

(Arranged alphabetically according to the names oi companies.)

ALBANY & HUDSON RAILROAD CO., Hudson, N. Y.

President, Clinton L. Rossiter; Vice-President, A. M. Young; Secretary and Treasurer, H. G. Runkle; Auditor, A. P. Deeds; General Manager, William Darbee; General and Mechanical Inspector, R. P. Leavitt.

ALTOONA AND LOGAN VALLEY ELECTRIC RAILWAY CO., Altoona, Pa.

President, J. J. Sullivan; Vice-President, H. J. Crowley; Secretary and Treasurer, C. L. S. Tingley; Comptroller, F. J. Pryor, Jr.; General Manager, S. S. Crane; Claim Agent, S. P. Hare; Chief Engineer, A. S. Kibbe.

ANDERSON TRACTION CO., Anderson, S. C.

President and Treasurer, Edwin W. Robertson; Vice-President, F. G. Brown; Secretary and Auditor, C. I. Dawson; General Manager, W. Elliott, Jr.; Electrical Engineer, J. E. Sirriul.

ANNISTON ELECTRIC & GAS CO., Anniston, Ala.

President, S. Z. Mitchell; Secretary and Treasurer, H. M. Francis; General Manager, H. W. Sexton; Superintendent and Electrician, A. A. Jett; Chief Engineer, W. C. Reid.

ASHEVILLE ELECTRIC CO., Asheville, N. C.

President, J. E. Rankin; Vice-President, E. R. Coffin; Secretary and General Manager, H. W. Plummer; Treasurer, H. M. Francis.

ATLANTIC COAST ELECTRIC RAILWAY CO., Asbury Park, N. J.

President and General Manager, S. F. Hazelrigg; Vice-President, H. H. Rogers; Secretary and Auditor, G. B. Cade; Treasurer, H. H. Rogers, Jr.; Superintendent, C. E. Hereth.

ATLANTIC SHORE LINE RALWAY CO., Kennebunkport, Me.

President, E. M. Goodall; Vice-President, I. L. Meloon; Secretary, Fred. J. Allen; Treasurer, L. B. Goodall; Auditor, A. D. Foster; General Manager, W. G. Meloon; Chief Engineer, S. E. Woodbury.

AUGUSTA & AIKEN RAILWAY Co., Augusta, Ga.

President, W. T. Van Brunt; Vice-President, J. U. Jackson; Secretary and Treasurer, C. C. Tegethoff; Assistant Secretary and Assistant Treasurer, J. R. League; Auditor, T. C. Vason; General Manager, E. P. Wetmore; Electrical and Chief Engineer, J. A. Wells.

AURORA, ELGIN & CHICAGO RAILROAD Co., Wheaton, Ill.

President, L. J. Wolf; Vice-President. M. J. Mandelbaum; Secretary and Treasurer, H. C. Lang; Auditor, C. E. Flenner; General Manager, Edwin C. Faber; Superintendent, Jos. O'Hara; Purchasing Agent, N. P. Harvey; Chief Engineer and Roadmaster, Charles Jones; Chief Engineer Power Station, D. Sutherland; Electrical Engineer, E. F. Gould.

AUSTIN ELECTRIC RAILWAY Co., Austin, Tex.

President and General Manager, W. J. Jones; Vice-President, F. H. Watriss; Secretary, C. V. Peel; Treasurer, E. P. Wilmot; Chief Engineer, J. M. Aday; Electrical Engineer, J. Eggeling.

BANGOR RAILWAY & ELECTRIC Co., Bangor, Me.

President and General Manager, John R. Graham; Vice-President, Frank Silliman, Jr.; Secretary, Geo. T. Sewall; Treasurer, F. D. Oliver; Auditor, Charles A. Pearson, Jr.; Superintendent Railway, W. H. Snow; Chief Engineer, C. M. Tolman; Claim Agent, D. F. Snow.

BAY CITY TRACTION & ELECTRIC Co., Bay City, Mich.

President, H. D. Walbridge; First Vice-President, J. C. Weadock; Second Vice-President, B. C. Cobb; Secretary, Treasurer and Auditor, C. E. Mershon; General Manager, S. E. Wolff.

BEAUMONT TRACTION Co., Beaumont, Tex.

President, L. H. Dinkins; Secretary, Treasurer and Manager, Frank J. Duffy; Chief Engineer, C. A. Rhymes.

BENTON HARBOR–ST. JOE RAILWAY & LIGHT Co., Benton Harbor, Mich.

President, C. K. Minary; Vice-President, J. G. McMichael; Secretary, L. W. Botts; Treasurer and General Manager, H. C. Mason.

BINGHAMTON RAILWAY Co., Binghamton, N. Y.

President, G. Tracy Rogers; Vice-President, George E. Green; Secretary, John B. Rogers; Treasurer, H. C. Hardie; General Manager, Auditor and Claim Agent, J. P. E. Clark; Chief Engineer, J. H. Cole.

BIRMINGHAM RAILWAY, LIGHT AND POWER CO., Birmingham, Ala.

President and General Manager, A. H. Ford; Secretary, Joseph P. Ross; Treasurer and Auditor, Elmer M. White; Electrical Engineer, M. Sloan; Superintendent Railway Department, George H. Harris; Claim Agent, C. A. Avant.

BOSTON & MAINE RAILROAD CO.,
(CONCORD & MANCHESTER ELECTRIC BRANCH, Concord, N. H.)

President, Lucius Tuttle; Third Vice-President and General Manager, Frank Barr; Treasurer, Herbert E. Fisher; General Auditor, W. J. Hobbs; Chief Electrician, F. D. Hall; Chief Engineer, H. Bissell.

BOSTON & NORTHERN STREET RAILWAY CO., Boston, Mass.

President, P. F. Sullivan; Vice-President and General Manager, Robert S. Goff; Secretary, Chas. Williams; Treasurer, C. R. Rockwell; General Auditor, D. Dana Bartlett; Superintendent of Motive Power, C. F. Bancroft; Claim Agent, W. A. Rice.

BOSTON & WORCESTER STREET RAILWAY CO., Boston, Mass.

President, James F. Shaw; Vice-President, H. Fisher Eldredge; Secretary and Treasurer, George A. Butman; Auditor, A. E. Stone; General Superintendent, E. P. Shaw, Jr.; Chief Engineer, E. H. Rogers; Electrical Engineer, M. V. Ayers; Claim Agent, Guy Murchie.

BOSTON ELEVATED RAILWAY CO., Boston, Mass.

President, William A. Bancroft; Vice-President, Charles S. Sergeant; Treasurer, William Hooper; Comptroller, Henry L. Wilson; Secretary, Daniel L. Prendergast; Chief Engineer Motive Power, Paul Winsor; Electrical Engineer, John W. Corning; General Attorney, Russell A. Sears.

BRIDGETON AND MILLVILLE TRACTION CO., Bridgeton, N. J.

President, J. J. Sullivan; Vice-President, Henry J. Crowley; Secretary and Treasurer, C. L. S. Tingley; Comptroller, Frank J. Pryor, Jr.; General Manager, B. Frank Hires; Chief Engineer, A. S. Kibbe.

BROCKTON & PLYMOUTH STREET RAILWAY CO., Plymouth, Mass.

President, J. D. Thurber; Vice-President, C. I. Litchfield; Treasurer, A. Stuart Pratt; Secretary, Alvah K. Todd; Manager, Alba H. Warren; Chief Engineer, W. R. Morton.

BUFFALO & LAKE ERIE TRACTION Co., Buffalo, N. Y.

President, J. B. Mayer; Vice-President, L. B. Grant; Secretary and Treasurer, M. J. Dodge; General Manager, J. C. Calisch; Auditor, E. H. Stichel; Electrical Engineer, A. R. Myers; Claim Agent, M. M. Hedden.

BUTTE ELECTRIC RAILWAY Co., Butte, Mont.

President, William A. Clark; Vice-President, Jas. A. MacDonald; Secretary and Treasurer, Pierre V. C. Miller; General Manager, Jesse R. Wharton.

CALUMET ELECTRIC STREET RAILWAY Co., Chicago, Ill.

President and Receiver, Ira M. Cobe; Secretary, Treasurer and Auditor, F. G. Murray; General Manager, H. M. Sloan; Chief Engineer, C. J. Blanchard.

CAMDEN INTERSTATE RAILWAY Co., Huntington, W. Va.

President, Wm. C. Sproul; Vice-President, Wm. E. Chilton; Secretary and Treasurer, Thomas McK. Hays; General Manager, W. W. Magoon; Electrical and Chief Engineer, James Fagan.

CAPITAL TRACTION Co., Washington, D. C.

President, George T. Dunlop; Vice-President, Henry Hurt; Secretary, H. D. Crampton; Treasurer, R. D. Simms; Chief Engineer, David S. Carll; Claim Agent, G. Thomas Dunlop.

CEDAR RAPIDS & IOWA CITY RAILWAY & LIGHT Co., Cedar Rapids, Ia.

President and General Manager, William G. Dows; Vice-President, N. M. Hubbard, Jr.; Secretary and Treasurer, Isaac B. Smith; Auditor, Charles S. Woodward; Electrical Engineer, W. J. Greene.

CENTRAL PENNSYLVANIA TRACTION Co., Harrisburg, Pa.

President, Frank B. Musser; Vice-President, B. F. Myers; Secretary and Treasurer, William J. Calder; Chief Engineer, J. L. Sheppard; Claim Agent, C. L. Brinser.

CHARLESTON CONSOLIDATED RAILWAY, GAS & ELECTRIC Co., Charleston, S. C.

President, Philip H. Gadsden; Secretary and Auditor, P. J. Balaguer; Superintendent Railway Division, Theodore W. Passailaigue; Chief Electrician, Wallace W. Fuller.

CHARLOTTE ELECTRIC RAILWAY, LIGHT & POWER CO., Charlotte, N. C.

President and Treasurer, E. D. Latta; Vice-President, E. B. Springs; Secretary, J. L. Chambers; Auditor, F. W. Garrett; General Manager, E. D. Latta, Jr.; Chief Engineer, R. L. Wommack.

CHICAGO & JOLIET ELECTRIC RAILWAY CO., Joliet, Ill.

President, J. J. Sullivan; Vice-President, H. J. Crowley; Secretary and Treasurer, C. L. S. Tingley; Comptroller, F. J. Pryor, Jr.; Superintendent and Claim Agent, W. H. Heun; Chief Engineer, A. S. Kibbe.

CHICAGO & MILWAUKEE ELECTRIC RAILROAD CO., Chicago, Ill.

President, A. C. Frost; Vice-President, G. Ramsay; Secretary, P. A. Beach; Treasurer, W. O. Kilman; General Manager, R. B. Stearns; Chief Engineer, F. J. Geraghty; Claim Agent, E. H. Vivian.

CHICAGO CITY RAILWAY CO., Chicago, Ill.

President, T. E. Mitten; Secretary, R. B. Hamilton; Treasurer, F. D. Hoffman; Auditor, A. G. Mitten; Chief Engineer, H. B. Fleming; Claim Agent, R. S. Rowley.

CHICAGO UNION TRACTION CO., Chicago, Ill.

President and General Manager, J. M. Roach; Vice-Presidents, R. A. C. Smith and Walter H. Wilson; Secretary and Assistant Treasurer, Markham B. Orde; Treasurer, James H. Eckels; Auditor, F. E. Smith; General Superintendent, Robert R. Hertzog; Chief Engineer, J. Z. Murphy; Claim Adjuster, H. C. Bradley.

CHILLICOTHE ELECTRIC RAILROAD, LIGHT & POWER CO., Chillicothe, O.

President, George A. Vaughters; Vice-President, J. P. Phillips; Secretary, E. W. Holland; Treasurer, Michael Kramer; General Manager and General Superintendent, A. G. Moser; Chief Engineer, Charles Waymier.

CINCINNATI TRACTION CO., Cincinnati, O.

President, W. Kesley Schoepf; 1st Vice-President, J. B. Foraker, Jr.; 2d Vice-President and General Manager, Dana Stevens; 3d Vice-President, D. G. Edwards; Secretary, Walter A. Draper; Treasurer, A. L. Kasemeier; Assistant Secretary and Comptroller, W. H. MacAlister; Auditor, C. F. Callaway; General Superintendent, Robert E. Lee; Chief Engineer, Herbert McNulta; Claim Agent, J. H. Schoepf.

CITIZENS' ELECTRIC Co., Eureka Springs, Ark.

President, William M. Duncan; Vice-President and General Manager, M. D. Jordan; Secretary, E. M. Bare; Treasurer, T. L. Hawley; Auditor, J. A. Allen; Electrical Engineer, W. L. Dry.

CITIZENS' ELECTRIC STREET RAILWAY Co., Newburyport, Mass.

President, James F. Shaw; Vice-President, Thomas Lahey; Secretary and Treasurer, G. A. Butman; Superintendent and Purchasing Agent, O. F. Files; Engineer Power Station, James F. Fellows.

CLEVELAND ELECTRIC RAILWAY Co., Cleveland, O.

President, Horace E. Andrews; Vice-President, C. F. Emery; Secretary, H. J. Davies; Treasurer, G. S. Russell; Auditor, W. G. McDole; General Manager, John J. Stanley; Chief Engineer, E. J. Cook; Claim Agent, W. F. Weh.

CLEVELAND, PAINESVILLE & EASTERN RAILROAD Co., Willoughby, O.

President, E. W. Moore; Vice-President, J. A. Beidler; Secretary, Fred S. Borton; Treasurer, E. V. Hale; Assistant Secretary and Auditor, E. L. Schmock; General Manager, J. Jordan; Claim Agent, J. C. Ward.

CLEVELAND, SOUTHWESTERN & COLUMBUS RAILWAY Co., Cleveland, O.

President, F. T. Pomeroy; Vice-President, A. E. Akins; Secretary and Claim Agent, E. F. Schneider; Treasurer, J. O. Wilson; Auditor, H. B. Cavanaugh; General Superintendent, C. N. Wilcoxon; Chief Engineer, E. G. Hindert.

COLORADO SPRINGS & INTERURBAN RAILWAY Co., Colorado Springs, Colo.

President, D. H. Rice; Vice-President, A. G. Sharp; Secretary, William Lloyd; Treasurer, C. S. Chamberlain; Superintendent, B. M. Lathrop; Chief Engineer, C. E. Bibb; Claim Agent, J. O. Henry.

COLUMBUS, DELAWARE & MARION RAILWAY Co., Columbus, O.

President, John G. Webb; Vice-President, O. M. Gottschall; Secretary, H. B. Hane; Treasurer, N. J. Catrow; Auditor, A. F. Elkins; General Manager, George Whysall; Chief Engineer, C. F. Turner; Claim Agent, C. C. Williams.

COLUMBUS, NEW ALBANY & JOHNSTOWN TRACTION CO., Columbus, O.

President, W. D. Brickell; Vice-President, Daniel J. Ryan; Secretary, Treasurer and General Manager, L. P. Stephens; Chief Engineer, F. A. Little.

COLUMBUS RAILROAD CO., Columbus, Ga.

President, C. F. Wallace; Vice-President, E. H. George; Secretary, Alvah K. Todd; Treasurer, A. Stuart Pratt; Manager, F. E. Reidhead; Superintendent Transportation, John Cameron.

COLUMBUS RAILWAY & LIGHT CO., Columbus, O.

President, Robert E. Sheldon; 1st Vice-President, Treasurer and General Manager, Edward K. Stewart; 2d Vice-President, C. M. Clark; Secretary and Auditor, P. V. Burington; Chief Engineer, F. R. Brosius; Claim Adjuster, B. B. Davis.

CONCORD, MAYNARD & HUDSON STREET RAILWAY CO., Maynard, Mass.

President, Charles H. Persons; Vice-President, Walter R. Dame; Treasurer, Henry Tower; Secretary and Superintendent, John W. Ogden; Chief Engineer, W. L. Stone.

CONNECTICUT COMPANY (THE), New Haven, Conn.

President, Charles S. Mellen; 1st Vice-President, Calvert Townley; 2d Vice-President, H. M. Kochersperger; Secretary, J. G. Parker; Treasurer, A. S. May; General Manager, J. K. Punderford; Auditor, C. L. Campbell; Chief Engineer, M. T. Rider.

CONSOLIDATED RAILWAYS, LIGHT AND POWER CO. (THE), Wilmington, N. C.

President, Hugh MacRae; Vice-President, M. F. H. Gouverneur; Secretary, H. Woolcott; Treasurer, R. J. Jones; Auditor, W. H. Foster; Manager, A. B. Skelding; Chief Engineer, R. MacRae; Claim Agent, W. F. Corbett.

DALLAS CONSOLIDATED ELECTRIC STREET RAILWAY CO., Dallas, Tex.

President, J. B. Wilson; Vice-President, W. C. Connor; Secretary, Treasurer and General Manager, Edward T. Moore; Auditor, L. A. Bowers.

DANBURY & BETHEL STREET RAILWAY CO., Danbury, Conn.

President, S. C. Holley; Vice-President, S. H. Wagner; Secretary and Treasurer, M. H. Griffing; General Superintendent, G. H. Klinzing; Chief Engineer, John Walters.

DAYTON & TROY ELECTRIC RAILWAY CO., Dayton, O.

President, Harrie P. Clegg; Vice-President, C. B. Klegg; Secretary and General Manager, C. M. Paxton; Treasurer, J. K. McIntire; General Auditor, R. A. Crume; Engineer Power Station, C. Evans.

DAYTON & XENIA TRANSIT CO., Dayton, O.

President and General Manager, C. J. Ferneding; Vice-President, H. L. Ferneding; Secretary, A. C. Ozias; Treasurer, Edw. Canby; Auditor, R. J. Wells; Superintendent, T. A. Ferneding; Electrical Engineer, J. R. W. Gregg.

DAYTON, COVINGTON & PIQUA TRACTION CO., West Milton, O.

President, Dennis Dwyer; Vice-President, T. T. Robinson; Secretary and Manager, Edw. C. Spring; Chief Engineer, H. E. Cecil.

DE KALB, SYCAMORE & INTERURBAN TRACTION CO., De Kalb, Ill.

President, J. G. McMichael; Secretary and Treasurer, J. W. McMichael; General Manager, D. Thomson; Chief Engineer, H. L. Warne.

DENISON AND SHERMAN RAILWAY CO., Denison, Tex.

President and Treasurer, J. P. Crerar; Vice-President, John Crerar.

DENVER CITY TRAMWAY CO., Denver, Colo.

President, W. G. Evans; Vice-President and General Manager, John A. Beeler; Secretary and Treasurer, Thomas Keeley; Acting Auditor, W. A. Doty; Chief Engineer, C. A. Trease; Claim Agent, S. C. Dorsey.

DES MOINES CITY RAILWAY CO., Des Moines, Ia.

President, J. S. Polk; Vice-President, G. M. Hippee; Secretary, A. G. Maish; Treasurer and General Manager, George B. Hippee; Chief Engineer, Frank S. Cummins; Claim Agent, R. B. Alberson.

DETROIT UNITED RAILWAY, Detroit, Mich.

President and General Manager, Jere C. Hutchins; Vice-President, Arthur Pack; Secretary, Edwin Henderson; Treasurer, George H. Russel; Auditor, Irwin Fullerton; Master Mechanic, Sylvester Potter; Claim Agent, F. E. Rankin.

DULUTH STREET RAILWAY CO., Duluth, Minn.

President, C. G. Goodrich; Secretary and Auditor, S. L. Reichert; Treasurer, L. Mendenhall; General Manager, Herbert Warren; Chief Engineer, John Carson; Claim Agent, Thos. S. Wood.

EAST LIVERPOOL TRACTION & LIGHT CO. (THE), East Liverpool, O.

President, Van Horn Ely; Vice-President, C. A. Smith; Secretary and Treasurer, Edward McDonnell; General Manager, J. C. Rothery.

EASTON TRANSIT CO., Easton, Pa.

President and General Manager, H. R. Fehr; Vice-President, S. H. Hackett; Secretary and Treasurer, S. H. Sargent; Auditor, E. B. Maltby; Superintendent, R. H. Lerch; Engineer Maintenance of Way, G. E. Jenkins; Master Mechanic, C. F. Roberts.

EAST ST. LOUIS & SUBURBAN RAILWAY CO., East St. Louis, Ill.

President, C. M. Clark; Vice-President, L. C. Haynes; Secretary and Treasurer, George L. Estabrook; Electrical Engineer, D. Martignone.

EASTERN WISCONSIN RAILWAY & LIGHT CO., Fond du Lac, Wis.

Vice-President and General Manager, N. C. Draper; Secretary, H. F. Whitcomb, Jr.; Treasurer, William E. Cole; Chief Engineer, S. W. Marty.

ELGIN & BELVIDERE ELECTRIC CO., Chicago, Ill.

President, Hamilton Browne; Secretary and Treasurer, R. G. Arnold; General Manager, W. L. Arnold; Superintendent, George F. Faber.

ELMIRA WATER, LIGHT & RAILROAD CO., Elmira N. Y.

President, Ray Tompkins; Vice-President and General Manager, W. W. Cole; Secretary and Treasurer, H. M. Beardsley; Electrical Engineer, F. S. Nicholson.

EL PASO ELECTRIC RAILWAY CO., El Paso, Texas.

President, G. E. Tripp; Vice-President and Manager, C. W. Kellogg, Jr.; Secretary, A. K. Todd; Treasurer, A. Stuart Pratt; Chief Engineer, C. H. Courser; Claim Agent, W. S. Hunter.

ENID CITY RAILWAY CO., Enid, Okla.

President and General Manager, C. H. Bosler; Vice-President, S. M. Keohn; Secretary, E. T. Hall; Treasurer, E. S. Hackwait; Superintendent, C. Kline.

ERIE TRACTION CO., Erie, Pa.

President, F. F. Curtze; Vice-President, Wm. Spencer; Secretary, Treasurer, General Manager and Claim Agent, Chas. M. Hatch; Auditor, D. W. McDonald; Chief Engineer of Power Plant, D. G. Nelligan.

EVANSVILLE & EASTERN ELECTRIC RAILWAY, Evansville, Ind.

President, Wm. H. McCurdy; Secretary, M. B. Harper; Treasurer, M. S. Sonntag; General Manager, W. L. Sonntag; Chief Engineer, H. C. Batlin.

EVANSVILLE ELECTRIC RAILWAY CO., Evansville, Ind.

President, James Murdock; Vice-President, H. B. Smith; Secretary and Treasurer, Charles M. Murdock; Auditor, J. G. McKee; General Manager, R. R. Smith; Chief Engineer, R. H. Cole.

FAIRMONT & CLARKSBURG TRACTION CO., Fairmont, W. Va.

President, S. L. Watson; Vice-President, C. W. Watson; Secretary and Treasurer, Walton Miller; Auditor, A. K. Bowles; General Manager, A. J. Purinton; Chief Engineer, S. B. Miller.

FARMINGTON STREET RAILWAY CO., Hartford, Conn.

President and Treasurer, E. D. Robbins; Vice-President, D. N. Barney; Secretary and General Manager, C. E. Hubbard; Electrical Engineer, L. Gorry.

FISHKILL ELECTRIC RAILWAY CO., Fishkill-on-Hudson, N. Y.

President and Manager, J. T. Smith; Vice-President, W. J. Conklin; Secretary, W. H. Southard; Treasurer, G. F. Patterson; Chief Engineer, W. E. Blakely.

FITCHBURG & LEOMINSTER STREET RAILWAY CO., Fitchburg, Mass.

President, H. A. Willis; Vice-President, H. I. Wallace; Secretary, C. F. Baker; Treasurer, R. N. Wallis; General Manager, W. W. Sargent; Auditor, Eliab Parker; Chief Engineer, Gus L. Enfors; Claim Agent, H. K. Bennett.

FONDA, JOHNSTOWN & GLOVERSVILLE RAILROAD CO., Gloversville, N. Y.

President and General Manager, J. Ledlie Hees; Secretary and Treasurer, G. M. Place; Auditor, L. K. Brown; General Superintendent, W. H. Collins; Chief Engineer, F. A. Bagg; Claim Agent, William H. Hyland.

FORT WAYNE & SPRINGFIELD RAILWAY CO. (THE), Decatur, Ind.

President and General Manager, W. H. Fledderjohann; Vice-President, John H. Koenig; Secretary, B. A. Fledderjohann; Treasurer, M. H. Willson; Superintendent, T. W. Sheldon; Chief Engineer, A. W. Fishbaugh; Claim Agent, J. C. Lutz.

FORT WAYNE & WABASH VALLEY TRACTION CO., Fort Wayne, Ind.

President, J. Levering Jones; Vice-President, C. Murdock; Second Vice-President, H. J. McGowan; Secretary, S. B. Fleming; Treasurer, H. C. Paul; Auditor, H. E. Vordermark; General Manager, C. D. Emmons; Chief Engineer, H. L. Weber; Claim Agent, F. R. Fahlsing.

FRIES MANUFACTURING & POWER CO. (THE), Winston-Salem, N. C.

President and Claim Agent, H. E. Fries; Vice-Presidents, W. A. Blair and F. H. Fries; Secretary and Treasurer, B. J. Pfohl; Auditor, W. C. Crist; General Manager and Chief Engineer, J. J. Sigg.

GALESBURG & KEWANEE ELECTRIC RAILWAY CO., Kewanee, Ill.

President, W. H. Lyman; Vice-President, H. W. Crane; Secretary and Treasurer, F. M. Lay; General Manager, R. H. Hayward; Auditor, P. B. Howland.

GALVESTON ELECTRIC CO., Galveston, Tex.

President, Guy E. Tripp; Vice-President, Wilbur A. Carter; Secretary, Henry R. Hayes; Treasurer, A. S. Pratt; General Manager and Auditors, Stone and Webster; Chief Engineer, Fred J. Bennett, Jr.; Claim Agent, George F. Pierce.

GARDNER, WESTMINSTER & FITCHBURG STREET RAILROAD CO., Gardner, Mass.

President, E. F. Blodgett; Secretary and Treasurer, J. A. Stiles; Auditor and Assistant Treasurer, W. R. Dame; Manager and Superintendent, C. A. Jefts; Chief Engineer, E. Rumery.

GEORGIA RAILWAY & ELECTRIC CO., Atlanta, Ga.

President, P. S. Arkwright; Vice-President and Secretary, T. K. Glenn; Vice-President and Treasurer, G. W. Brine; Auditor, H. M. Milan; Electrical Engineer, S. A. Redding; Claim Agent, C. H. Mathews.

GRAND RAPIDS, HOLLAND & CHICAGO RAILWAY CO., Holland, Mich.

President, George Hendrie; Vice-President, William H. Beach; Secretary, Treasurer and General Manager, Strathearn Hendrie; Auditor, T. W. Gorman; Claim Agent, Charles Floyd.

GRAND RAPIDS RAILWAY CO., Grand Rapids, Mich.

President, C. M. Clark; Vice-President, L. J. Rindge; Secretary, Treasurer and General Manager, B. S. Hanchett; Auditor, C. A. Pearson, Jr.; Chief Engineer, A. C. Ogilby; Claim Agent, F. M. Webster.

GREAT FALLS STREET RAILWAY CO., Great Falls, Mont.

President, John D. Ryan; Vice-President, John G. Morony; Secretary and Treasurer, John C. Lalor; General Manager, E. I. Holland; Auditor, C. T. Boal; Electrical Engineer, G. H. Jay.

GROTON & STONINGTON STREET RAILWAY CO., Mystic, Conn.

President, Thos. Hamilton; Vice-President, B. F. Williams; Secretary, Chas. D. Noyes; Treasurer, Costello Lippett; General Manager and General Superintendent, John B. Crawford; Claim Agent, C. W. Comstock.

HARTFORD & SPRINGFIELD STREET RAILWAY CO., Warehouse-point, Conn.

President, Wm. A. Tucker; Secretary, Arthur Perkins; Treasurer, Chauncey Eldridge; General Manager, H. S. Newton; Engineer Power Station, William Young.

HELENA LIGHT & RAILWAY CO., Helena, Mont.

President, P. G. Gossler; Vice-President, M. H. Gerry, Jr.; Secretary, H. S. Collette; Treasurer, Geo. W. Bunnell, Jr.; Manager, C. E. A. Carr; Auditor, E. W. Prosser; Superintendent of Transportation, T. J. Kelkoin.

HOUGHTON COUNTY STREET RAILWAY Co., Houghton, Mich.

President, F. J. Bawden; Vice-President, H. G. Bradlee; Secretary, Henry R. Hayes; Treasurer, A. Stuart Pratt; Manager, W. H. McGrath; Chief Engineer, B. S. Walsh; Claim Agent, F. O. Mayotte.

HOUSTON ELECTRIC Co., Houston, Tex.

President, George J. Baldwin; Vice-President, G. E. Tripp; Secretary, A. K. Todd; Treasurer, A. Stuart Pratt; Manager, David Daly; Engineer, Flint McGregor; Claim Agent, M. D. Fields.

ILLINOIS CENTRAL TRACTION Co., Decatur, Ill.

President, W. B. McKinley; Vice-President and General Manager, L. E. Fischer; Secretary, T. B. Macauley; Treasurer, Geo. M. Mattis; General Auditor, B. E. Bramble; Chief Engineer, H. C. Hoagland; Claim Agent, Geo. W. Burton.

INDIANA, COLUMBUS & EASTERN TRACTION Co., Cincinnnati O.

President, W. Kesley Schoepf; Vice-Presidents, J. B. Foraker, Jr., N. McD. Crawford, D. G. Edwards; Secretary and Treasurer, F. A. Healy; Auditor, M. W. Glover; General Manager Western Division, J. L. Adams.

INDIANA UNION TRACTION Co., Anderson, Ind.

President, Arthur W. Brady; Vice-Presidents, J. L. Jones, W. Kesley Schoepf; Secretary and Treasurer, W. H. Forse, Jr.; Acting Auditor, Walter Shroyer; General Manager, H. A. Nicholl; Superintendent of Track and Roadway, W. C. Sparks; Claim Agent, E. C. Carpenter.

INDIANAPOLIS & CINCINNATI TRACTION Co., Indianapolis, Ind.

President and General Manager, Chas. L. Henry; Vice-President, Theo. F. Rose; Secretary, J. F. Wild; Treasurer, John J. Appell; Auditor, W. B. Wright; Chief Engineer, John W. Moore; Claim Adjuster, W. M. Frazee.

INDIANAPOLIS, COLUMBUS & SOUTHERN TRACTION Co., Columbus, Ind.

President, Joseph I. Irwin; Vice-President, W. G. Irwin; Secretary and Treasurer, Hugh T. Miller; Auditor, Ira E. Guthrie; General Manager, A. A. Anderson; Chief Engineer, Levi Crater; Special Agent, Robert O. Boyer.

INDIANAPOLIS TRACTION & TERMINAL Co., Indianapolis, Ind.

President, H. J. McGowan; Vice-President, E. B. Peck; Vice-President and General Manager, R. I. Todd; Secretary and Treasurer, W. F. Milholland; Auditor, Joseph A. McGowan; Chief Engineer, Charles Hogate; Mechanical Engineer, Thomas B. McMath; Claim Agent, George W. Bruce.

INTERNATIONAL RAILWAY Co., Buffalo, N. Y.

President, Henry J. Pierce; Vice-President, Nelson Robinson; Secretary and Treasurer, J. F. Slocum; Auditor, D. M. Deininger; General Manager, T. W. Wilson; Electrical Engineer, George A. Harvey; Claim Agent, A. J. Farrell.

INTER-URBAN RAILWAY Co., Des Moines, Iowa.

President and General Manager, H. H. Polk; Vice-President, E. P. Smith; Secretary, W. I. Haskit; Treasurer, G. B. Hippee; Auditor, Chas. L. Wright; Chief Engineer, F. S. Cummins; Claim Agent, C. M. Gladson.

IOWA & ILLINOIS RAILWAY Co., Clinton, Iowa.

President, G. E. Lamb; Vice-President, F. W. Ellis; Secretary, R. B. McCoy; Treasurer, C. B. Mills; General Manager, P. P. Crafts; Chief Engineer, G. D. Hettrick.

JACKSON CONSOLIDATED TRACTION Co., Jackson, Mich.

President, Bird S. Coler; Vice-President, W. A. Boland; Secretary and Treasurer, C. B. Hole; Auditor, W. L. Shipp; General Manager, J. P. Clark.

JACKSON ELECTRIC RAILWAY LIGHT & POWER Co., Jackson, Miss.

President, F. G. Jones; Vice-President, Benjamin H. Wells; Secretary and Treasurer, S. T. Carnes; Auditor, R. H. Allis; General Manager, F. G. Proutt.

JACKSONVILLE ELECTRIC Co., Jacksonville, Fla.

President, George J. Baldwin; Vice-President, H. G. Bradlee; Secretary, Alvah K. Todd; Treasurer, A. S. Pratt; General Manager, S. E. Williams; Chief Engineer, D. J. McDonald; Claim Agent, J. S. Harrison.

JOLIET & SOUTHERN TRACTION Co., Joliet, Ill.

President and General Manager, H. A. Fisher; Vice-President, J. M. Raymond; Secretary, J. K. Newhall; Treasurer and Chief Engineer, L. D. Fisher.

JOPLIN & PITTSBURG RAILWAY CO., Pittsburg, Kan.

President, J. J. Heim; Vice-President, J. W. Ground; Secretary and Treasurer, John A. Prescott; General Manager, P. P. Crafts; Chief Engineer, J. F. Pilgrim.

KANSAS CITY RAILWAY & LIGHT CO., Kansas City, Mo.

President, Bernard Corrigan; Secretary and Treasurer, W. E. Kirkpatrick; Auditor, J. A. Harder; General Manager and Chief Engineer, Charles N. Black; Claim Agent, W. A. Satterlee.

KANSAS CITY–WESTERN RAILWAY CO. (THE), Leavenworth, Kan.

President, C. F. Holmes; Vice-President, C. F. Hutchings; Secretary and Treasurer, S. D. Hutchings; Auditor, W. M. Bonar; Chief Engineer, A. I. Campbell.

KENNETT & COATESVILLE RAILROAD CO., Kennett Square, Pa.

President, J. W. Taylor; Secretary, Treasurer and General Manager, G. H. Dodge.

KINGSTON CONSOLIDATED RAILROAD CO., Kingston, N. Y.

President, Charles M. Preston; Vice-President and General Manager, C. Gordon Reel; Secretary, A. J. Phillips; Treasurer, A. Hasbrouck; Auditor, A. M. Day; Chief Engineer, M. J. Sullivan; Claim Agent, John Braun.

KNOXVILLE RAILWAY & LIGHT CO., Knoxville, Tenn.

President and General Manager, C. H. Harvey; Vice-President, W. S. Shields; Secretary, Leon Fender; Treasurer and Auditor, H. T. Bunn; Chief Engineer, J. H. Drake; Claim Agent, E. R. Roberts.

KOKOMO, MARION & WESTERN TRACTION CO., Kokomo, Ind.

President, George J. Marott; Vice-President, L. J. Kirkpatrick; Secretary, Treasurer and Manager, T. C. McReynolds; Auditor, C. C. Trees; Electrical Engineer, P. H. Palmer.

LAKE SHORE ELECTRIC RAILWAY CO., Norwalk, O.

President, E. W. Moore; First Vice-President, W. H. Price; Second Vice-President, Jay Cook, 3d; Secretary and Treasurer, F. W. Coen; Auditor, A. C. Henry; General Manager, F. J. Stout; Chief Engineer, J. T. Ross; Claim Agent, Harry Rimelspach.

LAREDO ELECTRIC & RAILWAY CO. (THE), Laredo, Tex.

President, G. Bedell Moore; Vice-President, J. H. Savage; Secretary and Treasurer, B. M. Hammond; General Manager and Claim Agent, Frank E. Scovill; Chief Engineer, J. B. Morton.

LAS VEGAS RAILWAY & POWER CO., Las Vegas, N. Mex.

President and General Manager, William A. Buddecke; Vice-President, August Barthels; Secretary and Treasurer, F. A. Barthels; Chief Engineer, Theodore MacConnell.

LEHIGH TRACTION CO., Hazleton, Pa.

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LEHIGH VALLEY TRANSIT CO., Allentown, Pa.

President, David Young; Vice-President and General Manager, W. S. Hall; Secretary and Treasurer, C. N. Wagner; Auditor, C. M. Walter; Chief Engineer, W. H. Hall; Claim Agent, R. H. Schoenen.

LEVIS COUNTY RAILWAY, Levis, Quebec.

General Manager, H. H. Morse; Auditor, F. W. Sharp.

LEXINGTON RAILWAY CO., Lexington, Ky.

President, J. Levering Jones; Vice-President, Louis des Cognets; Secretary, Thomas D. Murray; Treasurer, H. J. Delaney; General Manager, R. T. Gunn; Chief Engineer, George MacLeod; Claim Agent, R. C. Stoll.

LIMA & TOLEDO TRACTION CO., Lima, O.

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LITTLE ROCK RAILWAY & ELECTRIC CO., Little Rock, Ark.

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LORRAINE ELECTRIC RAILWAY CO., Baltimore, Md.

President and General Manager, L. G. Turner; Vice-President, J. H. Preston; Secretary, J. M. Blackburn; Treasurer, W. C. Page; Chief Engineer, C. M. Johnson.

LOUISVILLE & EASTERN RAILROAD CO., Loisville, Ky.

President, F. M. Fauvre; Vice-President, Treasurer and General Manager, Percival Moore; Secretary and Auditor, H. H. Bullitt; Treasurer, C. Edgar Elliott; General Superintendent, Richard Meriwether.

LOUISVILLE & SOUTHERN INDIANA TRACTION CO., New Albany, Ind.

President, Samuel Insull; Vice-President and Treasurer, R. W. Waite; Secretary, J. F. Stratton; General Manager, M. J. Insull; Superintendent, F. E. Cole; Claim Agent, Charles B. Scott.

LOUISVILLE RAILWAY CO., Louisville, Ky.

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LYNCHBURG TRACTION & LIGHT CO., Lynchburg, Va.

President and General Manager, R. D. Apperson; Vice-President, Charles R. Miller; Secretary and Treasurer, F. H. Shelton; Cashier, A. T. Powell; Chief Engineer, A. J. Kohler.

MAHONING & SHENANGO RAILWAY & LIGHT CO., New Castle, Pa.

President, E. N. Sanderson; First Vice-President, Randall Montgomery; Second Vice-President and General Manager, M. E. McCaskey; Secretary, Leighton Calkins; Treasurer, S. C. Rogers.

MANILA ELECTRIC RAILROAD & LIGHT CO., Manila, P. I.

President, Charles M. Swift; Vice-President, F. H. Reed; Second Vice-President and General Manager, Richard T. Laffin; Secretary and Treasurer, T. F. Wickham.

MASON CITY & CLEAR LAKE RAILWAY CO., Mason City, Iowa.

President, Treasurer and Manager, W. E. Brice; Vice-President, Secretary and Auditor, F. J. Hanlon; Chief Engineer, J. H. Lary; Chief Electrician, F. D. Way.

MEMPHIS STREET RAILWAY CO., Memphis, Tenn.

President, T. H. Tutwiler; Vice-President, J. H. Watkins; Secretary, Treasurer and Auditor, W. H. Burroughs; General Superintendent, E. W. Ford; Chief Engineer, G. B. Cornell; Claim Agent, C. B. Proctor.

MENOMINEE & MARINETTE LIGHT & TRACTION CO., Menominee, Mich.

President, Augustus Spies; Vice-President, S. M. Stephenson; Secretary and General Manager, Edward Daniell; Treasurer, Harry J. Brown.

MERIDIAN LIGHT & RAILWAY CO., Meridian, Miss.

President, A. J. Paterson; Vice-President, William H. Armbrecht; Secretary, Treasurer and Auditor, W. E. Terry; Manager, A. B. Paterson; Chief Engineer, F. L. Bailey; Claim Agent, C. M. Wright.

MEXICO ELECTRIC TRAMWAYS, LIMITED, City of Mexico, Mex.

President, F. S. Pearson; Secretary and Treasurer, Pedro Mendez y Mendez; Auditor, A. S. Palfray; General Manager and Superintendent, Harro Harrsen; Chief Engineer, P. H. Evans.

MICHIGAN UNITED RAILWAYS CO., Lansing, Mich.

President, Myron W. Mills; Vice-President, James R. Elliott; Secretary, Robert Morrison, Jr.; Treasurer, Pomeroy Ladue; General Manager, J. M. Bramlette; Chief Engineer, J. H. Kries; Claim Agent, M. J. Hobin.

MILFORD & UXBRIDGE STREET RAILWAY CO., Milford, Mass.

President, J. T. Manson; Vice-President, J. Willis Downs; Secretary, Wendell Williams; Treasurer, James E. Walker; General Manager, Walter L. Adams; Chief Engineer, F. M. Daniels; Claim Agent, Wendell Williams.

MILLVILLE TRACTION CO., Millville, N. J.

President, George Wood; Vice-President, Henry B. Kemble; Secretary G. H. Thomas; Treasurer and General Manager, D. C. Lewis; Chief Electrician, J. Straub.

MILWAUKEE ELECTRIC RAILWAY & LIGHT CO. (THE), Milwaukee, Wis.

President and General Manager, John I. Beggs; Vice-Presidents, Charles F. Pfister, C. W. Wetmore, W. N. Cromwell; Secretary, Silas W. Burt; Treasurer, George R. Sheldon; Comptroller, C. N. Duffy;

Auditor, G. W. Kalweit; Superintendent of Rolling Stock, E. W. Olds; Superintendent of Construction, F. G. Simmons; Chief Engineer of Power Plants, Charles J. Davidson; Claim Agent, M. S. Rausch.

MOBILE LIGHT & RAILROAD CO., Mobile, Ala.

President and Manager, J. H. Wilson; Vice-President, S. H. Wilson; Secretary, Z. E. Watson; Treasurer, C. N. T. White-Spunner; Claim Agent, R. W. Jones, Jr.

MONTREAL STREET RAILWAY CO., Montreal, Quebec.

President, L. J. Forget; Vice-President, K. W. Blackwell; Secretary, Patrick Dubee; Managing Director, W. G. Ross; Comptroller, H. E. Smith; Manager, D. McDonald; Chief Engineer, R. M. Hannaford; Claim Agent, A. Gadona.

NAHANT & LYNN STREET RAILWAY CO., Lynn, Mass.

President, William La Croix; Vice-President, B. W. Currier; Treasurer, Clifton Colburn; General Manager and Electrical Engineer, J. E. Dozier.

NASHVILLE RAILWAY AND LIGHT CO., Nashville, Tenn.

President and General Manager, Percy Warner; Vice-President, J. C. Bradford; Secretary and Treasurer, H. C. Walters; Chief Engineer, W. G. Cameron; Claim Agent, Kinney Harmon.

NEW HAMPSHIRE ELECTRIC RAILWAYS, Haverhill, Mass.

President, D. A. Belden; Vice-President, Alex. S. Webb, Jr.; Secretary and Treasurer, F. J. Horne; Auditor, S. P. Russell; General Manager, Franklin Woodman; Chief Engineer, G. C. Pike; Claim Agent, E. S. Ellis.

NEW JERSEY & HUDSON RIVER RAILWAY & FERRY CO., Edgewater, N. J.

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NEW ORLEANS RAILWAY & LIGHT CO., New Orleans, La.

President, E. C. Foster; Vice-President and Secretary, Joseph H. DeGrange; Treasurer and Auditor, H. A. Ferrandou; Chief Engineer, E. B. McKinney; Claim Agent, W. H. Renaud, Jr.

NEWPORT NEWS & OLD POINT RAILWAY & ELECTRIC CO., Hampton, Va.

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NEWTON & BOSTON STREET RAILWAY CO., Newtonville, Mass.

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NEW YORK & PORTCHESTER RAILROAD CO., New York, N. Y.

General Manager, W. C. Gotshall; Chief Engineer, C. O. Mailloux.

NEW YORK & QUEENS COUNTY RAILWAY CO., New York, N. Y.

President and General Manager, F. L. Fuller; Secretary, H. M. Fisher; Treasurer, D. W. McWilliams; Auditor, I. M. Tritt; Chief Engineer, W. Slater; Claim Agent, John T. Bray.

NEW YORK CITY RAILWAY CO., New York, N. Y.

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NORFOLK & PORTSMOUTH TRACTION CO., Norfolk, Va.

President, R. Lancaster Williams; Vice-President, Frank O. Briggs; Secretary and Treasurer, W. J. Kehl; Auditor, W. C. Baker; General Manager, E. C. Hathaway; Chief Engineer, E. S. Ely; Claim Agent, George B. Bryan.

NORTHAMPTON TRACTION CO., Easton, Pa.

President, Thomas A. H. Hay; Vice-President, H. H. Haines; Secretary, W. O. Hay; Treasurer, Chester Snyder; General Superintendent, D. L. Beaulieu; Chief Engineer, Erwin Judd; Claim Agent, C. B. Brunner.

NORTHERN INDIANA RAILWAY CO., South Bend, Ind.

President, Arthur Kennedy; Vice-President and General Manager, J. McM. Smith; Secretary, M. P. Reed; Treasurer, James B. McCance; Auditor, R. L. McCance; Electrician, H. N. Ashenfelter.

NORTHERN OHIO TRACTION & LIGHT CO., Akron, O.

President, H. A. Everett; Vice-President, Will Christy; General Manager, Charles Currie; Secretary, C. F. Moore; Treasurer, J. R. Nutt; Chief Engineer, R. Trumbull; Claim Agent, T. W. Wakeman.

NORTHERN TEXAS TRACTION CO., Fort Worth, Texas.

President, G. E. Tripp; Vice-President and General Manager, H. T. Edgar; Secretary and General Superintendent, G. H. Clifford; Treasurer, A. S. Pratt; Chief Engineer, H. M. Flanders; Claim Agent, W. C. Forbess.

OHIO RIVER ELECTRIC RAILWAY & POWER CO., Pomeroy, O.

President, Percy M. Chandler; Vice-President and General Manager, John Blair MacAfee; Secretary, J. C. Moore; Treasurer and Auditor, Joseph T. Walmsley; Electrical Engineer, C. E. Price.

OKLAHOMA CITY RAILWAY CO., Oklahoma City, Okla.

President, Anton H. Classen; Vice-President, John W. Shartel; Secretary and Auditor, Henry M. Brauer; Treasurer, George H. Brauer; General Superintendent, Charles W. Ford.

OLYMPIA LIGHT & POWER CO., Olympia, Wash.

President, Hazard Stevens; Vice-President, N. W. Jordan; Secretary, John F. Souther; Treasurer, General Manager and Claim Agent, L. B. Faulkner.

OMAHA & COUNCIL BLUFFS STREET RAILWAY CO., Omaha, Neb.

President, G. C. Barton; Vice-President, G. W. Wattles; Secretary, R. A. Leussler; Treasurer and General Manager, W. A. Smith; Chief Engineer, H. B. Noyes; Claim Agent, A. W. Gross.

OMAHA, LINCOLN & BEATRICE RAILWAY CO., Lincoln, Neb.

President, Harvey Musser; Vice-President, H. H. Wilson; Secretary, Treasurer and General Manager, E. C. Hurd; Auditor, H. S. Norton.

OTTAWA ELECTRIC RAILWAY Co., Ottawa, Ontario.

President, T. Ahearn; Vice-President, Peter Whelen; Secretary and Treasurer, James D. Fraser; Auditor, R. Quain; Superintendent, J. E. Hutcheson.

OWOSSO & CORUNNA ELECTRIC Co., Owosso, Mich.

President, George H. Stephenson; Secretary and Treasurer, J. Tracy Eustis; General Manager, Lawrence Manning.

PACIFIC TRACTION Co., Tacoma, Wash.

President, J. R. Thompson; Vice-President and Treasurer, E. J. Felt; Secretary, A. E. Rothermel; Auditor, Wm. Petrie; General Manager, Benjamin J. Weeks; Chief Engineer, L. A. Nicholson.

PADUCAH TRACTION Co., INC. (THE), Paducah, Ky.

President, J. L. Friedman; Vice-President, D. P. Robinson; Secretary, Alvah K. Todd; Treasurer, A. Stuart Pratt; Manager and Claim Agent, John S. Bleecker; Electrical and Chief Engineer, H. C. Foss.

PENSACOLA ELECTRIC Co., Pensacola, Fla.

President, George J. Baldwin; Vice-President, Wilbur A. Carter; Treasurer, A. Stuart Pratt; Assistant Treasurer, R. G. Carroll; Manager, John W. Leadley; Chief Engineer, J. L. Sweeny; Claim Agent, O. J. Semmes.

PEOPLE'S RAILWAY Co. (THE), Dayton, O.

President, J. A. McMahon; Vice-President, Henry J. Crowley; Secretary and Treasurer, C. L. S. Tingley; Comptroller, F. J. Pryor, Jr.; General Manager, George C. Towle; Chief Engineer, Thos. Synnett; Claim Agent, V. R. Powell.

PETALUMA & SANTA ROSA RAILWAY Co., Petaluma, Cal.

President, Wm. A. Cattell; Vice-President, John A. McNear; Secretary and Treasurer, Thomas Archer; Auditor, W. G. Taylor; General Manager, E. M. Van Frank.

PETERBOROUGH RADIAL RAILWAY Co. (THE), Peterborough, Ont.

President, Robert Stuart; Vice-President, J. C. Shook; Secretary, Robert Gordon; General Manager, J. H. Larmonth; Electrical Engineer, H. O. Fisk.

PHILADELPHIA & WEST CHESTER TRACTION CO., Philadelphia, Pa.

President, A. M. Taylor; Vice-President, Wm. S. Taylor; Secretary, H. H. Aikens; Treasurer, C. L. Rihl; Auditor, H. F. Sieber; Chief Engineer, W. A. Hall; Claim Agent, A. B. Hearn.

PHILADELPHIA & WESTERN RAILWAY CO., Philadelphia, Pa.

President, G. R. Sheldon; Vice-President, Thomas Newhall; Secretary and Treasurer, Davies Murdoch; Auditor, Arthur E. Post; General Superintendent, W. H. Simms; Electrical Engineer, C. C. Long.

PHILADELPHIA RAPID TRANSIT CO., Philadelphia, Pa.

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PITTSBURG & BUTLER STREET RAILWAY CO., Butler, Pa.

President, Geo. Heard; Vice-President, Charles Gibson, Jr.; Secretary, G. F. Batchelor; General Manager, W. H. Pape; Electrical Engineer, L. H. Kidder.

PORTLAND RAILROAD CO., Portland, Me.

President, Charles F. Libby; Secretary, Treasurer and General Manager, Edward A. Newman; Chief Engineer, W. E. Knowlton.

PORTLAND RAILWAY CO., Portland, Ore.

President, B. S. Josslyn; Vice-President and General Manager, F. I. Fuller; Secretary, C. N. Huggins; Treasurer, Samuel G. Reed; Assistant Secretary and Assistant Treasurer, G. L. Estabrook; Claim Agent, E. E. Mallory.

PORTSMOUTH, DOVER & YORK STREET RAILWAY CO., Portsmouth, N. H.

President, E. M. Goodall; Vice-President, I. L. Meloon; Secretary, Fred J. Allen; Treasurer, L. B. Goodall; Auditor, A. D. Foster; General Manager, W. G. Meloon; Chief Engineer, S. E. Woodbury.

POTTSVILLE UNION TRACTION CO., Pottsville, Pa.

President and General Manager, W. E. Harrington; Vice-President, W. L. Shaefer; Secretary and Treasurer, F. B. Lasher; Electrical Engineer, E. W. Gough; Claim Agent, T. J. Evans.

POUGHKEEPSIE CITY & WAPPINGERS FALLS ELECTRIC RAILWAY CO., Poughkeepsie, N. Y.

President and General Manager, J. W. Hinkley, Jr.; Secretary and Treasurer, Silas Hinkley.

PROVIDENCE & DANIELSON RAILWAY CO., Providence, R. I.

President, D. F. Sherman; Vice-President, James S. Kenyon; Secretary, Franklin A. Smith, Jr.; Treasurer, George W. Prentice; General Superintendent, J. E. Thielsen; Electrical Engineer, J. I. Stubbert.

PUBLIC SERVICE RAILWAY CO., Newark, N. J.

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PUEBLO & SUBURBAN TRACTION & LIGHTING CO. (THE), Pueblo, Colo.

President, G. F. Duncan; Vice-President, W. B. McKinley; Secretary, H. C. Baker; Auditor, A. S. Cooper; Treasurer and General Manager, J. F. Vail; Chief Engineer, V. R. Hughes; Claim Agent, H. P. Vories.

QUINCY HORSE RALWAY & CARRYING CO., Quincy, Ill.

President, G. T. Duncan; Vice-President, W. B. McKinley; Secretary, Edward Woodman; Treasurer, W. H. Carnahan; Auditor, W. J. Achelpohl; General Manager, H. E. Chubbuck; Chief Engineer, C. H. Gibbs.

RALEIGH ELECTRIC CO., Raleigh, N. C.

President, W. J. Andrews; Vice-President, H. A. Barre; Secretary and Treasurer, J. A. P. Farnham; Auditor, H. H. Dalton; General Manager, H. H. Carr; Chief Engineer, H. C. Taylor.

RHODE ISLAND CO. (THE), Providence, R. I.

President, C. S. Mellen; Vice-Presidents, A. T. Potter, E. G. Buckland, H. M. Hockersperger; Secretary, J. G. Parker; Treasurer, A. S. May; General Manager, A. E. Potter; Comptroller, R. W. Shepherd; Chief Engineer, M. H. Bronsdon; Claim Agent, H. D. Briggs.

RICHMOND & PETERSBURG ELECTRIC RAILWAY CO., Richmond, Va.

President, F. Sitterding; 1st Vice-President, F. J. Gould; 2d Vice-President, A. Wright; Secretary and Treasurer, Guy Phillips; Assistant General Auditor, J. A. McKnight; General Manager, S. W. Huff; General Auditor, R. H. Keim; Chief Engineer, Calvin Whiteley, Jr.; Claim Agent, F. W. Mulford.

RICHMOND LIGHT & RAILROAD CO., New Brighton, N. Y.

President, H. H. Rogers; Vice-President and General Manager, S. F. Hazelrigg; Secretary, J. E. Phillips; Treasurer, H. H. Rogers, Jr.; Auditor, T. B. Bradley; Superintendent Railroad Division, T. J. Mullen; Chief Engineer, Frank O'Malley; Claim Agent, P. J. Finn.

ROANOKE RAILWAY & ELECTRIC CO., Roanoke, Va.

President, R. D. Apperson; Vice-President, Charles R. Miller; Secretary and Treasurer, F. H. Shelton; General Manager, J. W. Hancock; Electrical Engineer, R. Woltz.

ROCHESTER RAILWAY CO., Rochester, N. Y.

President, H. E. Andrews; Vice-Presidents, W. K. Vanderbilt, Jr., John J. Stanley; Secretary and Auditor, J. C. Collins; Treasurer, E. L. Rossiter; General Manager, E. J. Cook; Chief Engineer, I. E. Matthews; Claim Agent, J. E. Joyce.

ROCKFORD & INTERURBAN RAILWAY CO., Rockford, Ill.

President, R. N. Baylies; Vice-President, John Farson; Secretary, G. G. Olmsted; Treasurer, W. F. Woodruff; Auditor, F. W. McAssey; Manager, T. M. Ellis.

ROCK ISLAND SOUTHERN RAILROAD CO., Monmouth, Ill.

President, M. A. Walsh; Vice-President, C. W. Gale; Secretary, General Manager and Superintendent, W. W. McCullough; Treasurer, J. W. Walsh; Chief Engineer, F. H. Lanchshire.

ROCKLAND, THOMASTON & CAMDEN STREET RAILWAY CO., Rockland, Me.

President, George E. Macomber; Vice-President, Sidney M. Bird; Secretary, Herbert M. Heath; Treasurer, Augustus D. Bird; General Manager, Thomas Hawkens; Chief Engineer, Charles E. Gregory.

RUTLAND RAILWAY, LIGHT & POWER CO., Rutland, Vt.

President, G. T. Rogers; Vice-President, Leo H. Wise; Secretary and Treasurer, Charles H. West; General Manager, David Fox; Electrical Engineer, Thomas L. Roach.

SAGINAW VALLEY TRACTION Co., Saginaw, Mich.

President, H. D. Walbridge; Vice-President and General Manager, S. E. Wolff; Secretary, Treasurer and Auditor, A. J. Simpson; Electrical Engineer, Frank Gavagan; Claim Agent, John Goodrow.

ST. JOSEPH RAILWAY, LIGHT, HEAT & POWER Co., St. Joseph, Mo.

President, John Donovan; Vice-President and General Manager, J. H. Van Brunt; Vice-President, E. W. Clark, Jr.; Secretary and Treasurer, G. L. Estabrook; Assistant Secretary and Auditor, Charles E. Foster; Chief Engineer, R. A. Foresman; Claim Agent, F. J, Steven.

SAN ANTONIO TRACTION Co., San Antonio, Tex.

President, Emerson McMillin; Vice-President and General Manager, W. B. Tuttle; Secretary and Auditor, C. J. Thomas; Treasurer, O. O. Woodman; Chief Engineer, G. H. Cushman; Claim Agent, R. H. L. Bridgman.

SAN DIEGO ELECTRIC RAILWAY Co., San Diego, Cal.

President, John D. Spreckels; Vice-President and Managing Director, William Clayton; Secretary and Treasurer, H. L. Titus; Auditor, A. H. Kayser; General Superintendent, B. M. Warner; Chief Engineer, Charles McLogan.

SAN JUAN LIGHT & TRANSIT Co., San Juan, Porto Rico.

President, P. G. Gossler; Vice-President, F. H. Reed; Secretary, H. S. Collette; Treasurer, G. W. Bunnell; Assistant Treasurer, Lloyd Lyon; Manager, C. F. Beames.

SAVANNAH ELECTRIC Co., Savannah, Ga.

President, George J. Baldwin; Vice-President, C. F. Wallace; Secretary, Abraham Minis; Treasurer, A. Stuart Pratt; Manager, L. R. Nash; Chief Engineer, F. M. Yawger; Claim Agent, E. W. O'Connor.

SCHENECTADY RAILWAY Co., Schenectady, N. Y.

President, F. A. Harrington; Secretary and Treasurer, J. H. Aitken; Auditor, Fred Ruby; General Manager, E. F. Peck; Superintendent, E. J. Ryon; Chief Engineer, B. Penoyer; Claim Agent, H. Robinson.

SCIOTO VALLEY TRACTION Co. (THE), Columbus, O.

President and General Manager, F. A. Davis; Vice-President, W. S. Courtright; Secretary and Treasurer, E. R. Sharp; Auditor, F. K. Young; Superintendent, C. Skinner; Civil Engineer, Julian Griggs; Claim Agent, N. E. Rees, SCRANTON RAILWAY CO., Scranton, Pa.

President, J. J. Sullivan; Vice-President, H. J. Crowley; Secretary and Treasurer, C. L. S. Tingley; Comptroller, F. J. Pryor, Jr.; General Manager, Frank Caum; Chief Engineer, A. S. Kibbe; Claim Agent, Stephen Dwyer.

SEATTLE ELECTRIC CO., Seattle, Wash.

President, Jacob Furth; Vice-President, Charles D. Wyman; Secretary, J. B. Howe; Treasurer, A. S. Pratt; Assistant Treasurer, Frank Dabney; General Managers, Stone & Webster; Manager, Howard F. Grant; Auditor, W. E. Wilmot; Chief Engineer, Mark Lowd; Claim Agent, C. A. Hammond.

SHEBOYGAN LIGHT, POWER & RAILWAY CO., Sheboygan, Wis.

President, F. A. C. Perrine; Treasurer and General Manager, Ernest Gonzenbach; Secretary, J. A. Chesney; Auditor, Aug. Westermeyer; Chief, W. B. Voth.

SIOUX CITY TRACTION CO., Sioux City, Ia.

President, Samuel McRoberts; Secretary and Treasurer, J. H. Ricker; Auditor, H. O. Black; General Manager, Edwin L. Kirk; Chief Engineer, M. W. Lake; Master Mechanic, C. M. Feist; Claim Agent, Henry Morrison.

SOUTH CHICAGO CITY RAILWAY CO., Chicago, Ill.

President, D. F. Cameron; Vice-President, D. M. Cummings; Secretary and Treasurer, O. S. Gaither; Auditor, William R. Gaither; General Manager, George R. Folds.

SOUTHERN WISCONSIN RAILWAY CO., Madison, Wis.

President, F. W. Montgomery; Vice-President, Dudley Montgomery; Secretary and Treasurer, Warren Montgomery; Chief Electrician, M. Stumpf.

SOUTH SHORE TRACTION CO., New York, N. Y.

Secretary, A. C. Hume.

SOUTH-WESTERN TRACTION CO., London, Ont.

President, F. G. Rumball; Vice-President, A. McKay; Secretary-Treasurer, A. E. Welch; General Manager, S. W. Mower; Auditor, H. R. Skirving; Chief Engineer, C. P. Raikes; Electrical Engineer, D. P. Roberts.

SOUTHWEST MISSOURI RAILROAD Co., Webb City, Mo.

President, Treasurer and General Manager, A. H. Rogers; Vice-President, E. Z. Wallower; Secretary, A. G. Knisely; Auditor, W. E. McMechan; Chief Engineer, J. B. Hodgon; Claim Agent, S. W. Gunsalus.

SPOKANE TRACTION Co., Spokane, Wash.

President, J. P. Graves; Vice-President, A. L. White; Secretary, C. H. Wolf; Treasurer, H. B. Ferris; Auditor, E. B. Bird; General Manager, C. M. Graves; Chief Engineer, A. M. Lupfer; Claim Agent, C. M. Delameter.

SPRINGFIELD CONSOLIDATED RAILWAY Co., Springfield, Ill.

President, H. D. Walbridge; Vice-President and General Manager, Emil G. Schmidt; Secretary and Treasurer, H. T. Willett; Chief Engineer, H. H. Jones; Claim Agent, C. S. Goodwell.

SPRINGFIELD RAILWAY Co. (THE), Springfield, O.

President, Oscar T. Martin; Vice-President, Henry J. Crowley; Secretary and Treasurer, C. L. S. Tingley; Auditor, Frank J. Pryor, Jr.; General Manager, John H. Miller; Chief Engineer, A. S. Kibbe; Claim Agent, Paul C. Martin.

SPRINGFIELD TRACTION Co., Springfield, Mo.

President, Geo. E. Macomber; Vice-President, General Manager and Purchasing Agent, W. A. Bixby; Secretary, N. J. Cunningham; Treasurer, E. B. Lewis; Auditor, T. E. Smith; Chief Engineer, J. M. Brown.

STERLING, DIXON & EASTERN ELECTRIC RAILWAY Co., Sterling, Ill.

President, John I. Beggs; Vice-President and General Manager, E. B. Kirk; Secretary and Treasurer, Robert Camp; Auditor, Frank Higgins; Electrical Engineer, A. L. Gillette.

STEUBENVILLE & EAST LIVERPOOL RAILWAY & LIGHT Co., Steubenville, O.

President, Van Horn Ely; Secretary and Treasurer, Edward McDonnell; General Manager, J. C. Rothery; Chief Engineer, George Jackson.

SYRACUSE & SUBURBAN RAILROAD Co., Syracuse, N. Y.

President, J. L. King; Vice-President and General Manager, C. E. Hubbell; Secretary and Treasurer, G. H. Stillwell; Chief Engineer, G. E. Higgins.

SYRACUSE, LAKE SHORE & NORTHERN RAILROAD CO., Syracuse, N. Y.

President, C. D. Beebe; Vice-Presidents, C. B. Benson, H. S. Holden; Secretary, J. M. Gilbert; Treasurer, A. K. Hiscock; General Manager, Wm. B. Rockwell; Auditor, W. W. Foster; Chief Engineer, T. H. Mather; Claim Agent, H. C. Beatty.

SYRACUSE RAPID TRANSIT RAILWAY CO., Syracuse, N. Y.

President, Horace E. Andrews; Vice-President and General Manager, C. Loomis Allen; Secretary and Treasurer, T. H. Conderman; Auditor, J. M. Joel; Superintendent, J. E. Duffy; Engineer, E. P. Roundy; Claim Agent, L. E. Barnes; Master Mechanic, Fred DuBois.

TACOMA RAILWAY AND POWER CO., Tacoma, Wash.

President, Russell Robb; Vice-President, E. L. Carr; Secretary, A. K. Todd; Treasurer, A. Stuart Pratt; Assistant Secretary and Assistant Treasurer, J. S. Simpson; General Managers, Stone & Webster; Manager, W. S. Dimmock; Claim Agent, E. H. Odell.

TAMPA ELECTRIC CO., Tampa, Fla.

President, George J. Baldwin; Vice-President, Peter O. Knight; Treasurer, A. Stuart Pratt; Secretary, A. K. Todd; General Managers, Stone & Webster; Manager, George W. Wells; Chief Engineer, H. A. Hampton.

TERRE HAUTE, INDIANAPOLIS & EASTERN TRACTION CO., Indianapolis, Ind.

President, Robert Todd; Vice-President; C. Murdock; Secretary, C. Mulholland; Treasurer, J. A. McGowan; Auditor, L. T. Hixson; General Manager, C. C. Reynolds; Electrical Engineer, P. I. Zipp.

TERRE HAUTE TRACTION & LIGHT CO., Terre Haute, Ind.

President, W. R. McKeen; Vice-President, R. I. Todd; Secretary and Treasurer, Jos. A. McGowan; Auditor, E. J. Davis; General Manager, T. F. Grover; Chief Engineer, H. E. Smith; Claim Agent, W. G. McComb.

TOLEDO & CHICAGO INTERURBAN RAILWAY CO., Kendallville, Ind.

President, A. B. Shepard; Vice-President, Treasurer and General Manager, F. B. Perkins; Secretary, F. L. Welsheimer; Auditor, W. R. Robins.

TOLEDO RAILWAYS & LIGHT Co., Toledo, O.

President, H. A. Everett; Vice-President and General Manager, L. E. Beilstein; Secretary and Auditor, H. S. Swift; Treasurer, S. D. Carr; Chief Engineer, J. T. Ross; Claim Agent, E. H. Eckert.

TOLEDO URBAN & INTERURBAN RAILWAY Co., Findlay, O.

President, G. B. Kerper; Vice-President, John Kilgour; Secretary and Treasurer, A. J. Becht; Auditor, W. I. McClure; General Manager, C. F. Smith; Chief Engineer, Charles Kilgour.

TOPEKA RAILWAY Co., Topeka, Kan.

President, E. W. Wilson; Vice-President and General Manager, L. E. Meyers; Secretary and Treasurer, F. G. Kelley; Auditor, E. C. Flowers; General Superintendent, A. M. Patten.

TORONTO RAILWAY Co., Toronto, Ont.

President, William MacKenzie; Vice-President, Frederic Nicholls; Secretary and Treasurer, James C. Grace; Comptroller, J. M. Smith; Manager, R. J. Fleming; Superintendent, James Gunn; Chief Engineer, T. Tushingham.

TRI-CITY RAILWAY Co., Davenport, Ia.

President, J. F. Porter; Vice-President and General Manager, J. F. Lardner; Secretary, Treasurer and Auditor, H. E. Weeks; Chief Engineer, F. W. Reimers; Claim Agent, R. W. Holland.

TRI-STATE TRACTION Co., Steubenville, O.

General Manager, J. F. Flood; Superintendent, S. E. McCoy.

TRINIDAD ELECTRIC RAILROAD Co. (THE), Trinidad, Colo.

President, Frank P. Read; Vice-President, E. H. Day; Secretary, Treasurer and General Manager, G. L. Horton; Auditor, J. E. Findley; Master Mechanic, John Davey.

TUCSON RAPID TRANSIT Co., Tucson, Ariz.

President, Wm. S. Iliff; Vice-President and General Manager, Frank E. Russell; Secretary, C. K. Durbin; Treasurer and Auditor, O. S. Moore.

TWIN CITY RAPID TRANSIT Co., Minneapolis, Minn.

President, Thomas Lowry; Vice-President, Calvin G. Goodrich; Secretary and Comptroller, E. S. Pattee; Treasurer, E. A. Crosby; Auditor, D. J. Strouse; General Manager, W. J. Hield; Chief Engineer, E. H. Scofield; Claim Agent, W. O. Stout.

UNION ELECTRIC CO., Dubuque, Ia.

President, F. D. Stout; Vice-President, D. D. Meyers; Secretary and Treasurer, J. R. Lindsay; Manager, L. D. Mathes; Auditor, M. E. Crabtree; Chief Engineer, C. E. Stanton.

UNION STREET RAILWAY CO., New Bedford, Mass.

President, Henry H. Crapo; Vice-President, Thomas B. Tripp; Secretary, C. A. Cook; Treasurer, E. S. Wilde; General Superintendent, E. E. Potter; Chief Engineer, Jos. Moore; Claim Agent, I. W. Phelps.

UNITED RAILWAYS & ELECTRIC CO. (THE), Baltimore, Md.

President, William A. House; Vice-President, F. A. Furst; Secretary, William Early; Acting Treasurer, J. H. Windsor; Auditor, N. E. Stubbs; General Manager, T. A. Cross; Consulting Engineer, L. B. Stillwell; Chief Engineer, C. O. Vandevauter; Superintendent of Shops, H. H. Adams; Claim Agent, J. R. Pratt.

UNITED RAILWAYS CO. OF ST. LOUIS, St. Louis, Mo.

President, John I. Beggs; Vice-President and General Manager, Robert McCulloch; Secretary and Treasurer, James Adkins; Auditor, Frank R. Henry; Assistant General Manager, Richard McCulloch; Master Mechanic, M. O'Brien; General Claim Agent, C. B. Hardin.

UNITED TRACTION CO., Albany, N. Y.

President, David Wilcox; Vice-President, A. I. Culver; Secretary and Treasurer, James McCredie; Acting Auditor, David C. Dibbell; General Manager, Edgar S. Fassett; Electrical Engineer, Herschel A. Benedict.

UTAH LIGHT & RAILWAY CO., Salt Lake City, Utah.

President, W. H. Bancroft; Vice-Presidents, P. L. Williams, W. S. McCornick; Secretary, F. H. Knickerbocker; Treasurer, George S. Gannett; Auditor, W. Brown; General Manager, J. S. Wells; Electrical Engineer, O. A. Honnold.

UTICA & MOHAWK VALLEY RAILWAY CO., Utica, N. Y.

President, Horace E. Andrews; Vice-President, John J. Stanley; Secretary, Walter N. Kernan; Treasurer, Charles B. Rogers; General Manager, C. Loomis Allen; Auditor, B. A. Frankel; Electrical Engineer, W. J. Harvie; Claim Agent, R. E. McDougall.

VALLEY TRACTION CO., Chambersburg, Pa.

President, M. C. Kennedy; Secretary and Treasurer, W. L. Ritchey; Auditor, C. M. Davison; Superintendent, C. H. Bishop; Chief Engineer, J. M. Reich.

WALLKILL TRANSIT CO. (THE), Middletown, N. Y.

President, Edw. R. Sponsler; Vice-President, Herbert B. Royce; Secretary, W. H. Sponsler; Treasurer, W. M. Oglesby; General Manager, D. C. McMonagle; Electrical Engineer, H. Van Innegen.

WASHINGTON, BALTIMORE & ANNAPOLIS ELECTRIC RAILWAY CO., Baltimore, Md.

President, G. T. Bishop; Vice-President, John Sherwin; Secretary and Treasurer, J. G. Masterton; Auditor, W. A. Kappler; General Manager, J. N. Shannahan.

WASHINGTON RAILWAY & ELECTRIC CO., Washington, D. C.

President, Allan L. McDermott; Vice-President, George H. Harries; Secretary, F. J. Whitehead; Treasurer and Comptroller, William F. Ham; General Manager, H. W. Fuller; Engineer, C. S. Kimball.

WASHINGTON WATER POWER CO. (THE), Spokane, Wash.

President, Henry M. Richards; Vice-President, A. B. Campbell; Second Vice-President and General Manager, D. L. Huntington; Secretary, H. L. Bleecker; Treasurer, H. E. Perks.

WEST CHESTER STREET RAILWAY CO., West Chester, Pa.

President, Meyer Schamberg; Vice-President and Secretary, Jonas Rice; Treasurer, John W. Woodside; Auditor, A. A. Du Ban; Superintendent, E. W. Goss.

WEST PENN RAILWAYS CO., Pittsburg, Pa.

President, W. S. Kuhn; Vice-President, James S. Kuhn; Secretary, Robert P. Watt; Treasurer, J. B. Van Wagener; General Manager, W. E. Moore; Chief Engineer, J. L. Fritsch.

WHATCOM COUNTY RAILWAY & LIGHT CO., Bellingham, Wash.

President, C. D. Wyman; Vice-President, J. W. Hallowell; Secretary, H. R. Hayes; Treasurer, A. S. Pratt; General Managers, Stone & Webster; Auditor, J. C. Hector; Local Manager, L. H. Bean; Chief Engineer, H. Titcomb.

WHEELING TRACTION CO., Wheeling, W. Va.

President, T. H. Conderman; Vice-Presidents, J. J. Holloway, B. W. Peterson; Secretary and Treasurer, W. A. Shirley; General Manager, G. O. Nagle; Chief Engineer, A. G. Mersing; Claim Agent, Louis Lipphardt.

WICHITA RAILROAD & LIGHT CO., Wichita, Kan.

President, George F. Duncan; Vice-President and General Manager, Samuel L. Nelson; Secretary and Treasurer, Edward Woodman; General Superintendent, W. R. Morrison; Chief Engineer, E. C. Clemmons.

WILLIAMSPORT PASSENGER RAILWAY CO., Williamsport, Pa.

President, Henry W. White; Vice-President, C. L. Munson; Secretary, Treasurer and General Manager, Ernest H. Davis; Auditor, H. H. Hill; Chief Engineer, P. A. Hess.

WINNEBAGO TRACTION CO., Oshkosh, Wis.

President, R. H. Hackett; Vice-President and General Manager, E. B. Kirk; Secretary, A. H. Ostram; Treasurer, S. M. Rothermal; Chief Engineer, M. J. Hill.

WINONA INTERURBAN RAILWAY CO., Winona Lake, Ind.

President, H. J. Heinz; Vice-President, J. F. Beyer; Secretary and General Manager, S. C. Dickey; Treasurer, William M. Camp; General Superintendent, H. S. Dickey; Chief Engineer, Charles Sigler.

WINONA RAILWAY & LIGHT CO., Winona, Minn.

President, C. M. Mason; Vice-President, J. S. Bartlett; Secretary and Treasurer, E. L. Carr; Auditor, F. Martin; General Manager, A. V. Schroeder; Chief Engineer, Robert Paton.

WORCESTER CONSOLIDATED STREET RAILWAY CO., Worcester, Mass.

President, F. H. Dewey; Vice-President, A. G. Bullock; Treasurer, J. W. Lester; General Manager, E. G. Connette; Superintendent of Motive Power, G. W. Dunlap; Claim Agent, H. E. Buswell.

YEGAN BROTHERS POWER PLANT, Billings, Mont.

Manager, J. E. Brayton.

YORK STREET RAILWAY CO., York, Pa.

President, W. F. B. Stewart; Vice-President, A. H. Hayward; Secretary and Treasurer, George S. Schmidt; General Manager, David Young, Jr.; Auditor, H. F. Greenwalt; Chief Engineer, L. C. Mayer; Claim Agent, J. A. Hoober.

YOUNGSTOWN & SOUTHERN RAILWAY CO., Youngstown, O.

President, John Stambaugh; Vice-President and General Manager, S. J. Dill; Secretary and Treasurer, David Todd; Auditor and Assistant Treasurer, W. F. Bass; Chief Engineer, Geo. Tod, Jr.

## MEMBER COMPANIES,

(Arranged Alphabetically According to States.)

### ALABAMA.

| | |
|---|---|
| Anniston | Anniston Electric and Gas Co. |
| Birmingham | Birmingham Railway, Light and Power Co. |
| Mobile | Mobile Light and Railroad Co. |

### ARIZONA.

| | |
|---|---|
| Tucson | Tucson Rapid Transit Co. |

### ARKANSAS.

| | |
|---|---|
| Eureka Springs | Citizens' Electric Co. |
| Little Rock | Little Rock Railway and Electric Co. |

### CALIFORNIA.

| | |
|---|---|
| Petaluma | Petaluma and Santa Rosa Railway Co. |
| San Diego | San Diego Electric Railway Co. |

### COLORADO.

| | |
|---|---|
| Colorado Springs | Colorado Springs and Interurban Ry. Co. |
| Denver | Denver City Tramway Co. |
| Pueblo | The Pueblo and Suburban Traction and Lighting Co. |
| Trinidad | The Trinidad Electric Railroad Co. |

### CONNECTICUT.

| | |
|---|---|
| Danbury | Danbury and Bethel Street Railway Co. |
| Hartford | Farmington Street Railway Co. |
| Mystic | Groton and Stonington Street Railway Co. |
| New Haven | Connecticut Co. (The) |
| Warehousepoint | Hartford and Springfield Street Railway Co. |

### DISTRICT OF COLUMBIA.

| | |
|---|---|
| Washington | Capital Traction Co. |
| Washington | Washington Railway and Electric Co. |

## FLORIDA.

| | |
|---|---|
| Jacksonville | Jacksonville Electric Co. |
| Pensacola | Pensacola Electric Co. |
| Tampa | Tampa Electric Co. |

## GEORGIA.

| | |
|---|---|
| Athens | Athens Electric Railway Co. |
| Atlanta | Georgia Railway and Electric Co. |
| Augusta | Augusta and Aiken Railway Co. |
| Columbus | Columbus Railroad Co. |
| Savannah | Savannah Electric Co. |

## ILLINOIS.

| | |
|---|---|
| Chicago | Calumet Electric Street Railway Co. |
| Chicago | Chicago and Milwaukee Electric Railroad Co. |
| Chicago | Chicago City Railway Co. |
| Chicago | Chicago Union Traction Co. |
| Chicago | Elgin and Belvidere Electric Co. |
| Chicago | South Chicago City Railway Co. |
| Decatur | Illinois Central Traction Co. |
| DeKalb | DeKalb-Sycamore and Interurban Traction Co. |
| East St. Louis | East St. Louis and Suburban Railway Co. |
| Joliet | Chicago and Joliet Electric Railway Co. |
| Joliet | Joliet and Southern Traction Co. |
| Kewanee | Galesburg and Kewanee Electric Railway Co. |
| Monmouth | Rock Island Southern Railroad Co. |
| Quincy | Quincy Horse Railway and Carrying Co. |
| Rockford | Rockford and Interurban Railway Co. |
| Springfield | Springfield Consolidated Railway Co. |
| Sterling | Sterling, Dixon and Eastern Electric Railway Co. |
| Wheaton | Aurora, Elgin and Chicago Railroad Co. |

## INDIANA.

| | |
|---|---|
| Anderson | Indiana Union Traction Co. |
| Columbus | Indianapolis, Columbus and Southern Traction Co. |
| Decatur | The Ft. Wayne and Springfield Railway Co. |
| Evansville | Evansville and Eastern Electric Railway. |
| Evansville | Evansville Electric Railway Co. |

Ft.. Wayne......Ft. Wayne and Wabash Valley Traction Co.
Indianapolis........Indianapolis and Cincinnati Traction Co.
Indianapolis........Indianapolis Traction and Terminal Co.
Kokomo........Kokomo. Marion and Western Traction Co.
New Albany...Louisville and Southern Indiana Traction Co.
Richmond. Terre Haute, Indianapolis and Eastern Traction Co.
South Bend.................Northern Indiana Railway Co.
Terre Haute............Terre Haute Traction and Light Co.
Winona Lake..............Winona Interurban Railway Co.

## IOWA.

Cedar Rapids..Cedar Rapids and Iowa City Ry. and Light Co.
Clinton.......................Iowa and Illinois Railway Co.
Davenport...........................Tri-City Railway Co.
Des Moines..................Des Moines City Railway Co.
Des Moines.......................Inter-Urban Railway Co.
Dubuque ..............................Union Electric Co.
Mason City.........Mason City and Clear Lake Railway Co.
Sioux City......................Sioux City Traction Co.

## KANSAS.

Leavenworth........The Kansas City-Western Railway Co.
Pittsburg.................Joplin and Pittsburg Railway Co.
Topeka ..........................Topeka Railway Co.
Wichita..................Wichita Railroad and Light Co.

## KENTUCKY.

Lexington........................Lexington Railway Co.
Louisville.............Louisville and Eastern Railroad Co.
Louisville..........................Louisville Railway Co.
Paducah.................The Paducah Traction Co. (Inc.)

## LOUISIANA.

New Orleans...........New Orleans Railway and Light Co.

## MAINE.

Bangor...................Bangor Railway and Electric Co.
Kennebunkport...........Atlantic Shore Line Railway Co.
Portland..........................Portland Railroad Co.
Rockland...Rockland, Thomaston and Camden Street Ry. Co.

## MARYLAND.

| | |
|---|---|
| Baltimore | Lorraine Electric Railway Co. |
| Baltimore | The United Railways and Electric Co. |
| Baltimore | Washington, Baltimore and Annapolis Elec. Ry. Co. |

## MASSACHUSETTS.

| | |
|---|---|
| Boston | Boston and Maine Railroad Co. |
| Boston | Boston and Northern Street Railway Co. |
| Boston | Boston and Worcester Street Railway Co. |
| Boston | Boston Elevated Railway Co. |
| Fitchburg | Fitchburg and Leominster Street Railway Co. |
| Gardner | Gardner, Westminster and Fitchburg St. R. R. Co. |
| Haverhill | New Hampshire Electric Railways. |
| Lynn | Nahant and Lynn Street Railway Co. |
| Maynard | Concord, Maynard and Hudson Street Ry. Co. |
| Milford | Milford and Uxbridge Street Railway Co. |
| New Bedford | Union Street Railway Co. |
| Newburyport | Citizens' Electric Street Railway Co. |
| Newtonville | Newton and Boston Street Railway Co. |
| Plymouth | Brockton and Plymouth Street Railway Co. |
| Worcester | Worcester Consolidated Street Railway Co. |

## MICHIGAN.

| | |
|---|---|
| Benton Harbor | Benton Harbor–St. Joe Ry. and Light Co. |
| Detroit | Detroit United Railway. |
| Grand Rapids | Grand Rapids Railway Co. |
| Holland | Grand Rapids, Holland and Chicago Railway Co. |
| Houghton | Houghton County Street Railway Co. |
| Jackson | Jackson Consolidated Traction Co. |
| Lansing | Michigan United Railways Co. |
| Menominee | Menominee and Marinette Light and Traction Co. |
| Owosso | Owosso and Corunna Electric Co. |
| Saginaw | Bay City Traction and Electric Co. |
| Saginaw | Saginaw Valley Traction Co |

## MINNESOTA.

| | |
|---|---|
| Duluth | Duluth Street Railway Co. |
| Minneapolis | Twin City Rapid Transit Co. |
| Winona | Winona Railway and Light Co. |

## MISSISSIPPI.

| | |
|---|---|
| Jackson | Jackson Electric Railway, Light and Power Co. |
| Meridian | Meridian Light and Railway Co. |

## MISSOURI.

| | |
|---|---|
| Kansas City | Kansas City Railway and Light Co. |
| St. Joseph | St. Joseph Ry., Light, Heat and Power Co. |
| St. Louis | United Railways Co. of St. Louis. |
| Springfield | Springfield Traction Co. |
| Webb City | Southwest Missouri Railroad Co. |

## MONTANA.

| | |
|---|---|
| Billings | Yegan Brothers' Power Plant. |
| Butte | Butte Electric Railway Co. |
| Great Falls | Great Falls Street Railway. |
| Helena | Helena Light and Railway Co. |

## NEBRASKA.

| | |
|---|---|
| Lincoln | Omaha, Lincoln and Beatrice Railway Co. |
| Omaha | Omaha and Council Bluffs Street Railway Co. |

## NEW HAMPSHIRE.

| | |
|---|---|
| Portsmouth | Portsmouth, Dover and York Street Ry. Co. |

## NEW JERSEY.

| | |
|---|---|
| Asbury Park | Atlantic Coast Electric Railway Co. |
| Bridgeton | Bridgeton and Millville Traction Co. |
| Edgewater | N. J. and Hudson River Ry. and Ferry Co. |
| Millville | Millville Traction Co. |
| Newark | Public Service Railway Co. |

## NEW MEXICO.

| | |
|---|---|
| Las Vegas | Las Vegas Railway and Power Co. |

## NEW YORK.

| | |
|---|---|
| Albany | Albany and Hudson Railroad Co. |
| Albany | United Traction Co. |
| Binghamton | Binghamton Railway Co. |
| Buffalo | Buffalo and Lake Erie Traction Co. |

| | |
|---|---|
| Buffalo | International Railway Co. |
| Elmira | Elmira Water, Light and Railroad Co. |
| Fishkill-on-Hudson | Fishkill Electric Railway Co. |
| Gloversville | Fonda, Johnstown and Gloversville Railroad Co. |
| Kingston | Kingston Consolidated Railroad Co. |
| Middletown | The Wallkill Transit Co. |
| New York | Long Island Consolidated Electrical Cos. |
| New York | New York and Port Chester Railroad Co. |
| New York | New York and Queens County Railway Co. |
| New York | New York City Railway Co. |
| New York | Richmond Light and Railroad Co. |
| New York | South Shore Traction Co. |
| Po'keepsie | Po'keepsie City and Wappingers Falls El. Ry. Co. |
| Rochester | Rochester Railway Co. |
| Schenectady | Schenectady Railway Co. |
| Syracuse | Syracuse and Suburban Railroad Co. |
| Syracuse | Syracuse, Lake Shore and Northern R. R. Co. |
| Syracuse | Syracuse Rapid Transit Railway Co. |
| Utica | Utica and Mohawk Valley Railway Co. |

## NORTH CAROLINA.

| | |
|---|---|
| Asheville | Asheville Electric Co. |
| Charlotte | Charlotte Electric Railway, Light and Power Co. |
| Raleigh | Raleigh Electric Co. |
| Wilmington | The Consolidated Railways, Light and Power Co. |
| Winston-Salem | The Fries Manufacturing and Power Co. |

## OHIO.

| | |
|---|---|
| Akron | Northern Ohio Traction and Light Co. |
| Chillicothe | Chillicothe Electric Railroad, Light and Power Co. |
| Cincinnati | Cincinnati Traction Co. |
| Cleveland | Cleveland Electric Railway Co. |
| Cleveland | Cleveland, South-West'n & Columbus Railway Co. |
| Cleveland | Lake Shore Electric Railway Co. |
| Cleveland | Cleveland, South-West'n & Columbus Railway Co. |
| Columbus | Columbus Railway and Light Co. |
| Columbus | Indiana, Columbus and Eastern Traction Co. |
| Columbus | The Scioto Valley Traction Co. |
| Dayton | Dayton and Troy Electric Railway Co. |
| Dayton | Dayton and Xenia Transit Co. |

| | |
|---|---|
| Dayton | The Peoples Railway Co. |
| East Liverpool | The East Liverpool Traction and Light Co. |
| Findlay | Toledo, Urban and Interurban Railway Co. |
| Lima | Lima and Toledo Traction Co. |
| Marion | Columbus, Delaware and Marion Railway Co. |
| Pomeroy | Ohio River Electric Railway and Power Co. |
| Springfield | The Springfield Railway Co. |
| Steubenville | Steubenville and E. Liverpool Ry. and Light Co. |
| Steubenville | Tri-State Traction Co. |
| Toledo | Toledo and Chicago Interurban Railway Co. |
| Toledo | Toledo Railways and Light Co. |
| West Milton | Dayton, Covington and Piqua Traction Co. |
| Willoughby | Cleveland, Painesville and Eastern Railroad Co. |
| Youngstown | Youngstown and Southern Railway Co. |

## OKLAHOMA.

| | |
|---|---|
| Enid | Enid City Railway Co. |
| Oklahoma City | Oklahoma City Railway Co. |

## OREGON.

| | |
|---|---|
| Portland | Portland Railway Co. |

## PENNSYLVANIA.

| | |
|---|---|
| Allentown | Lehigh Valley Transit Co. |
| Altoona | Altoona and Logan Valley Electric Railway Co. |
| Butler | Pittsburg and Butler Railway Co. |
| Chambersburg | Valley Traction Co. |
| Connellsville | West Penn. Railways Co. |
| Easton | Easton Transit Co. |
| Easton | Northampton Traction Co. |
| Erie | Erie Traction Co. |
| Harrisburg | Central Pennsylvania Traction Co. |
| Hazelton | Lehigh Traction Co. |
| Kennett Square | Kennett & Coatesville Railroad Co. |
| New Castle | Mahoning and Shenango Ry. and Light Co. |
| Philadelphia | Philadelphia and Western Railway Co. |
| Philadelphia | Philadelphia and West Chester Traction Co. |
| Philadelphia | Philadelphia Rapid Transit Co. |
| Philadelphia | West Chester Street Railway Co. |
| Pottsville | Pottsville Union Traction Co. |

Scranton..........................Scranton Railway Co.
Williamsport...........Williamsport Passenger Railway Co.
York............................York Street Railway Co.

## RHODE ISLAND.

Providence..........Providence and Danielson Railway Co.
Providence........................ The Rhode Island Co.

## SOUTH CAROLINA.

Anderson..........................Anderson Traction Co.
Charleston..Charleston Consolidated Ry., Gas and Elec. Co.

## TENNESEE.

Knoxville.................Knoxville Railway and Light Co.
Memphis.....................Memphis Street Railway Co.
Nashville.................Nashville Railway and Light Co.

## TEXAS.

Austin........................Austin Electric Railway Co.
Beaumont........................Beaumont Traction Co.
Dallas.......Dallas Consolidated Electric Street Railway Co.
Denison...............Denison and Sherman Railway Co.
El Paso.....................El Paso Electric Railway Co.
Fort Worth.................Northern Texas Traction Co.
Galveston.........................Galveston Electric Co.
Houston..............................Houston Electric Co.
Laredo..............The Laredo Electric and Railway Co.
San Antonio....................San Antonia Traction Co.

## UTAH.

Salt Lake City................Utah Light and Railway Co.

## VERMONT.

Rutland............Rutland Railway, Light and Power Co.

## VIRGINIA.

Hampton....Newport News and Old Point Ry. and Elec. Co.
Lynchburg...............Lynchburg Traction and Light Co.
Norfolk.............Norfolk and Portsmouth Traction Co.

| | |
|---|---|
| Richmond | Richmond and Petersburg Electric Railway Co. |
| Roanoke | Roanoke Railway and Electric Co. |

## WASHINGTON.

| | |
|---|---|
| Bellingham | Whatcom County Railway and Light Co. |
| Olympia | Olympia Light and Power Co. |
| Seattle | Seattle Electric Co. |
| Spokane | Spokane Traction Co. |
| Spokane | The Washington Water Power Co. |
| Tacoma | Pacific Traction Co. |
| Tacoma | Tacoma Railway and Power Co. |

## WEST VIRGINIA.

| | |
|---|---|
| Fairmont | Fairmont and Clarksburg Traction Co. |
| Huntington | Camden Interstate Railway Co. |
| Wheeling | Wheeling Traction Co. |

## WISCONSIN.

| | |
|---|---|
| Fond du Lac | Eastern Wisconsin Railway and Light Co. |
| Madison | Southern Wisconsin Railway Co. |
| Milwaukee | The Milwaukee Electric Railway and Light Co. |
| Oshkosh | Winnebago Traction Co. |
| Sheboygan | Sheboygan Light, Power and Railway Co. |

## PHILIPPINE ISLANDS.

| | |
|---|---|
| Manila | Manila Electric Railroad and Light Co. |

## PORTO RICO.

| | |
|---|---|
| San Juan | San Juan Light and Transit Co. |

## CANADA.

| | |
|---|---|
| Levis, Quebec | Levis County Railway. |
| London, Ontario | South-Western Traction Co. |
| Montreal, Quebec | Montreal Street Railway Co. |
| Ottawa, Ontario | Ottawa Electric Railway Co. |
| Peterborough, Ontario | The Peterborough Radial Railway Co. |
| Toronto, Ontario | Toronto Railway Co. |

## MEXICO.

| | |
|---|---|
| City of Mexico | Mexico Electric Tramways, Limited. |

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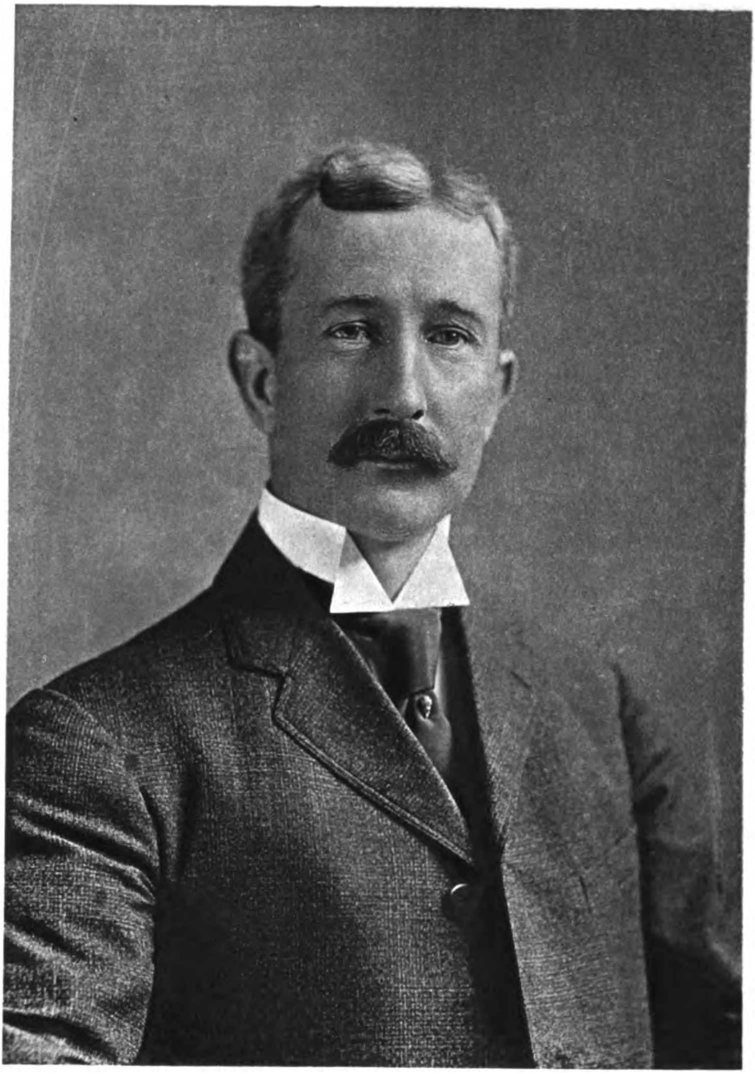

W. H. Adams

PRESIDENT 1906—1907
H. H. ADAMS, SUPERINTENDENT OF SHOPS
UNITED RAILWAYS AND ELECTRIC CO.
BALTIMORE, MD.

# PROCEEDINGS

OF THE

# AMERICAN STREET AND INTERURBAN RAILWAY

# ENGINEERING ASSOCIATION

## 1907

CONTAINING A COMPLETE REPORT OF THE FIFTH ANNUAL CONVENTION HELD AT THE STEEL PIER, ATLANTIC CITY, NEW JERSEY, OCTOBER 14, 15, 16, 1907

PUBLISHED BY THE
AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION
FROM THE OFFICE OF THE SECRETARY
29 WEST 39TH STREET, NEW YORK, N. Y.

THE NAME OF THIS ASSOCIATION WAS FORMERLY THE

AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION.

ORGANIZED AT CLEVELAND, OHIO, FEBRUARY 16, 1903.

REORGANIZED AT PHILADELPHIA, PA., SEPTEMBER 25, 1905.

J. B. LYON COMPANY, PRINTERS, ALBANY, N. Y.

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# OFFICERS, 1906-07.

(Officers of the 1907 Convention.)

---

PRESIDENT:

**H. H. ADAMS,**

Superintendent of Shops, The United Railways & Electric Co.,
BALTIMORE, MD.

FIRST VICE-PRESIDENT:

**FRED. G. SIMMONS,**

Superintendent of Construction and Maintenance of Way, The Milwaukee Electric Railway & Light Co.,
MILWAUKEE, WIS.

SECOND VICE-PRESIDENT:

**J. S. DOYLE,**

Superintendent of Car Equipment, Interborough Rapid Transit Co.,
NEW YORK, N. Y.

THIRD VICE-PRESIDENT:

**PAUL WINSOR,**

Chief Engineer of Motive Power and Rolling Stock, Boston Elevated Railway Co.,
BOSTON, MASS.

SECRETARY-TREASURER:

**S. W. MOWER,**

General Manager, South-Western Traction Co.,
LONDON, ONT.

---

## EXECUTIVE COMMITTEE:

THE OFFICERS AND

F. H. LINCOLN, Assistant General Manager, Philadelphia Rapid Transit Co., Philadelphia, Pa.
FRED N. BUSHNELL, Chief Engineer, The Rhode Island Co., Providence, R. I.
W. T. DOUGAN, Engineer Maintenance of Way, New York City Railway Co., New York, N. Y.
H. B. FLEMING, Chief Engineer, Chicago City Railway Co., Chicago, Ill.

## OFFICERS, 1907-08.

(Elected at the 1907 Convention.)

PRESIDENT:

**FRED G. SIMMONS,**

Superintendent of Construction and Maintenance of Way, The Milwaukee Electric Railway & Light Co.,

MILWAUKEE, WIS.

FIRST VICE-PRESIDENT:

**PAUL WINSOR,**

Chief Engineer Motive Power and Rolling Stock, Boston Elevated Railway Co.,

Ry. Co.,

BOSTON, MASS.

SECOND VICE-PRESIDENT:

**F. H. LINCOLN,**

Assistant General Manager, Philadelphia Rapid Transit Co.,

PHILADELPHIA, PA.

THIRD VICE-PRESIDENT:

**W. H. EVANS,**

Master Mechanic, International Railway Co.,

BUFFALO, N. Y.

SECRETARY-TREASURER:

**JOHN W. CORNING,**

Electrical Engineer, Boston Elevated Railway Co.,

BOSTON, MASS.

## EXECUTIVE COMMITTEE:

THE OFFICERS AND

W. J. HARVIE, Chief Engineer, Utica & Mohawk Valley Railway Co., Utica, N. Y.
WILLIAM ROBERTS, Superintendent of Motive Power, Northern Ohio Traction & Light Co., Akron, Ohio.
E. O. ACKERMAN, Engineer Maintenance of Way, Columbus Railway & Light Co., Columbus, Ohio.
JOHN Z. MURPHY, Electrical Engineer, Chicago Union Traction Co., Chicago, Ill.

## COMMITTEES, 1906–1907.

### Standardization.

W. H. **Evans**, *Chairman*, Master Mechanic, International Railway Co., Buffalo, N. Y.

H. **Wallerstedt**, Engineer, Ford, Bacon & Davis, New York, N. Y.

H. A. **Benedict**, Mechanical and Electrical Engineer, United Traction Co., Albany, N. Y.

H. B. **Fleming**, Superintendent Maintenance of Way and Structures, Chicago City Railway Co., Chicago, Ill.

J. M. **Larned**, Engineer Maintenance of Way, Pittsburg Railways Co., Pittsburg, Pa.

R. C. **Taylor**, Superintendent of Rolling Stock, Indiana Union Traction Co., Anderson, Ind.

H. W. **Blake**, Editor, Street Railway Journal, New York, N. Y.

C. B. **Fairchild, Jr.**, Editor, Electric Traction Weekly, Cleveland, Ohio.

### Control Apparatus.

J. S. **Doyle**, *Chairman*, Superintendent of Car Equipment, Interborough Rapid Transit Co., New York, N. Y.

G. J. **Smith**, Master Mechanic, Kansas City Railway & Light Co., Kansas City, Mo.

P. N. **Jones**, Electrical and Mechanical Engineer, Pittsburg Railways Co., Pittsburg, Pa.

### Maintenance and Inspection of Electrical Equipment.

**John Lindall**, *Chairman*, Superintendent of Motive Power and Machinery, Boston Elevated Railway Co., Boston, Mass.

W. D. **Wright**, Superintendent of Equipment, The Rhode Island Co., Providence, R. I.

E. T. **Munger**, Master Mechanic, Metropolitan West Side Elevated Railway Co., Chicago, Ill.

L. L. **Smith**, Master Mechanic, Chicago & Milwaukee Electric Railroad Co., Highwood, Ill.

### Maintenance of Way.

**Fred** G. **Simmons**, *Chairman*, Superintendent of Construction and Maintenance of Way, The Milwaukee Electric Railway and Light Co., Milwaukee, Wis.

T. K. **Bell**, Chief Engineer, Interstate Railways Co., Philadelphia, Pa.

C. A. **Alderman**, Chief Engineer, Cincinnati Traction Co., Cincinnati, Ohio.

*Committees* 1906–07 — (Continued.)

### Rail and Rail Matters.

(*Sub-Committee.*)

JULIAN GRIGGS, *Chairman,* Chief Engineer, Scioto Valley Traction Co., Columbus, Ohio.

CHAS. E. CLARK, Engineer, Maintenance of Way, International Railway Co., Buffalo, N. Y.

E. O. ACKERMAN, Engineer, Maintenance of Way, Columbus Railway & Light Co., Columbus, Ohio.

### Open vs. Closed Terminals for Car Storage,

E. W. OLDS, *Chairman,* Superintendent of Rolling Stock, The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

MARTIN SCHREIBER, Engineer, Maintenance of Way, Public Service Railway Co., Newark, N. J.

JOHN HANF, Master Mechanic, Public Service Railway Co., Camden, N. J.

### Operating and Storage Car House Designs,

F. N. BUSHNELL, *Chairman,* Engineer, Stone & Webster Engineering Corporation, Boston, Mass.

R. C. TAYLOR, Superintendent Motive Power, Indiana Union Traction Co., Anderson, Ind.

N. W. GRABURN, Master Mechanic, Montreal Street Railway Co., Montreal, Quebec.

## PRESIDENTS OF THE ASSOCIATION SINCE ORGANIZATION.

| | |
|---|---|
| 1903 | THOMAS FARMER. |
| 1903–04 | E. W. OLDS. |
| 1904–05 | C. F. BAKER. |
| 1905–06 | H. H. ADAMS. |
| 1906–07 | H. H. ADAMS. |

## CONVENTIONS OF THE ASSOCIATION SINCE ORGANIZATION.

| | | |
|---|---|---|
| 1903 | Saratoga Springs, N. Y. | September 1–3 |
| 1904 | St. Louis, Mo. | October 10–12 |
| 1905 | Philadelphia, Pa. | September 25–26 |
| 1906 | Columbus, Ohio | October 15–17 |
| 1907 | Atlantic City, N. J. | October 14–16 |

# OFFICERS SINCE ORGANIZATION.

## OFFICERS, ORGANIZATION MEETING.

(American Railway Mechanical and Electrical Association.)

*President:*
**THOMAS FARMER,**
Master Mechanic, Detroit United Railway, Detroit, Mich.

*First Vice-President:*
**E. W. OLDS,**
Superintendent of Rolling Stock, The Milwaukee Electric Railway and Light Co., Milwaukee, Wis.

*Second Vice-President:*
**ALFRED GREEN,**
Master Mechanic, Rochester Railway Co., Rochester, N. Y.

*Third Vice-President:*
**C. F. BAKER,**
Superintendent of Motive Power and Machinery, Boston Elevated Railway Co., Boston, Mass.

*Secretary and Treasurer:*
**S. W. MOWER,**
Detroit United Railway, Detroit, Mich.

EXECUTIVE COMMITTEE:
The Officers and
*W. O. Mundy, Master Mechanic, St. Louis Transit Co. ........St. Louis, Mo.
T. J. Mullen, Master Mechanic, Scranton Railway Co.............Scranton, Pa.
H. H. Adams, Sup't of Shops, The United Railways & Elec. Co...Baltimore, Md.
D. F. Carver, Chief Engineer, The Cleveland Electric Ry. Co....Cleveland, Ohio

Elected at the organization meeting, held in the Hollenden Hotel, Cleveland, Ohio, February 16, 1903.

## OFFICERS, 1903-1904.

*President:*
**E. W. OLDS,**
Superintendent of Rolling Stock, The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

*First Vice-President:*
**ALFRED GREEN,**
Master Mechanic, Rochester Railway Co., Rochester, N. Y.

*Second Vice-President:*
**C. F. BAKER,**
Superintendent of Motive Power and Machinery, Boston Elevated Railway Co., Boston, Mass.

*Third Vice-Presidnt:*
***W. O. MUNDY,**
Master Mechanic, St. Louis Transit Co., St. Louis, Mo.

*Secretary and Treasurer:*
**S. W. MOWER,**
Detroit United Railway, Detroit, Mich.

EXECUTIVE COMMITTEE:
The Officers and
T. J. Mullen, Master Mechanic, Scranton Railway Co.............Scranton, Pa.
H. H. Adams, Sup't of Shops, The United Railways & Elec. Co...Baltimore, Md.
D. F. Carver, Chief Engineer, Public Service Corporation of N. J..Jersey City, N. J.
H. J. Lake, Master Mechanic, Muncie, Hartford & Ft. Wayne Ry. Co., Muncie, Ind.

Elected at Saratoga Springs, N. Y., September 3, 1903.

---

*Deceased.

## OFFICERS, 1904–1905.

*President:*
C. F. BAKER,
Superintendent of Motive Power and Machinery, Boston Elevated Railway Co., Boston, Mass.

*First Vice-President:*
H. H. ADAMS,
Superintendent of Shops, The United Railways & Electric Co., Baltimore, Md.

*Second Vice-President:*
JOHN MILLAR,
Master Mechanic, International Railway Co., Buffalo, N. Y.

*Third Vice-President:*
FRED. G. SIMMONS,
Superintendent of Construction and Maintenance of Way, The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

*Secretary and Treasurer:*
S. W. MOWER,
Detroit United Railway, Detroit, Mich.

EXECUTIVE COMMITTEE:
The Officers and

D. F. Carver, Chief Engineer, Public Service Corporation of N. J. Jersey City, N. J.
J. S. Doyle, Master Mechanic, Interborough Rapid Transit Co. . New York, N. Y.
C. C. Lewis, Chief Engineer, Schenectady Railway Co........Schenectady, N. Y.
W. H. McAloney, Superintendent of Shops, Denver City Tramway Co. Denver, Col.

Mr. Lewis having gone abroad and resigned as a member of the Executive Committee, his place was filled in February, 1905, by the appointment of

E. W. Olds, Superintendent of Rolling Stock, The Milwaukee Electric Railway and Light Co., Milwaukee, Wis.

Elected at St. Louis, Mo., October 11, 1904.

## OFFICERS, 1905–1906.

### (American Street and Interurban Railway Engineering Association.)

*President:*
H. H. ADAMS,
Superintendent of Shops, The United Railways & Electric, Baltimore, Md.

*First Vice-President:*
FRED. G. SIMMONS,
Superintendent of Construction and Maintenance of Way, The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

*Second Vice-President:*
J. S. DOYLE,
Superintendent of Car Equipment, Interborough Rapid Transit Co., New York, N. Y.

*Third Vice-President:*
PAUL WINSOR,
Chief Engineer of Motive Power and Rolling Stock, Boston Elevated Railway Co., Boston, Mass.

*Secretary and Treasurer:*
S. W. MOWER,
General Manager, South-Western Traction Co., London, Ont.

EXECUTIVE COMMITTEE:
The Officers and

W. S. Twining, Chief Engineer, Philadelphia Rapid Transit Co. . Philadelphia, Pa.
Fred N. Bushnell, Chief Engineer, The Rhode Island Co......Providence, R. I.
W. Boardman Reed, Engineer Maintenance of Way, and Buildings, New York City Railway Co. . . New York, N. Y.
A. D. Campbell, Master Mechanic, Seattle Electric Co.............Seattle, Wash.

Mr. Reed having severed his connection with the New York City Railway Co., and resigned as a member of the Executive Committee, his place was filled, in August, 1906, by the appointment of

W. T. Dougan, Engineer Maintenance of Way and Buildings, New York City Railway Co. . New York, N. Y.

Elected at Philadelphia, Pa., September 26, 1905.

# CONVENTION PROGRAM.

(Atlantic City, New Jersey, October 14, 15 and 16, 1907.)

### *Monday*—9 00 A M to 12 30 P M

Registration at Steel Pier.

### *Monday*—2 00 P M to 5 00 P M

Convention Called to Order.

Address—John I. Beggs, President American Street and Interurban Railway Association.

Address of the President.

Annual Report of the Executive Committee.

Annual Report of the Secretary-Treasurer.

Appointment of Convention Committees.

Reports of Special Committees.

Report of Committee on Control Apparatus.

Report of Committee on Maintenance and Inspection of Electrical Equipment.

### *Tuesday*—9 30 A M to 12 30 P M

Report of Committee on Way Matters.

PAPER—"Care of Electric Railway Tracks," by George L. Wilson, Engineer, Twin City Rapid Transit Co., Minneapolis, Minn.

Report of Way Committee on "Rail Corrugation Investigation."

Report of Way Committee on "Concrete Tie Investigation."

Report of Sub-Committee on "Rail and Rail Matters."

### *Tuesday*—2 00 P M to 5 00 P M

Report of Committee on Standardization.

Report of Committee on Open vs. Closed Terminals for Car Storage.

Report of Committee on Operating and Storage, Car House Designs.

Question Box.

### *Wednesday*—9 30 A M to 1 00 P M

Joint Meeting of American Association and Affiliated Associations.

### *Wednesday*—2 30 P M to 5 30 P M

PAPER—"A Year's Experience with Gas Engines," by Paul Winsor, Chief Engineer Motive Power and Rolling Stock, Boston Elevated Railway Co., Boston, Mass.

PAPER—"Some Practical Points in Steam Turbine Construction; with Particular Reference to the Parsons Type," by St. John Chilton, Engineer, Allis-Chalmers Co., Milwaukee, Wis.

PAPER—"Operation of Curtis Turbines in Railway Service," by August H. Kruesi, Engineer, General Electric Co., Schenectady, N. Y.

PAPER—"Recent Developments in Steam Turbine Power Station Work," by J. R. Bibbins, Engineer, Westinghouse Machine Co., East Pittsburg, Pa.

General Business.

Election of Officers.

# REGISTRATION AT THE ATLANTIC CITY CONVENTION.

## PAST PRESIDENTS OF THE ASSOCIATION.

Olds, E. W., Superintendent of Rolling Stock, The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

Baker, C. F., Superintendent of Construction for L. B. Stilwell, New York, N. Y.

## DELEGATES OF MEMBER COMPANIES.

*ASSOCIATE MEMBER. *Note.*— Other Associate Members in attendance at the Convention of the Engineering Association (not delegates of member companies) are given in a separate list which follows the list of Delegates of Member Companies.

ALBANY & HUDSON RAILROAD CO.:
  Leavitt, R. P., General Mechanical and Electrical Superintendent.
ATLANTIC COAST ELECTRIC RAILWAY CO.:
  Hereth, C. E., Superintendent.
AURORA, ELGIN & CHICAGO RAILROAD CO.:
  Gould, E. F., Electrical Engineer.
BANGOR RAILWAY & ELECTRIC CO.:
  McCormick, Morris, Master Mechanic.
BOSTON & MAINE RAILROAD CO.:
  *Hall, F. D., Chief Electrician.
BOSTON & NORTHERN STREET RAILWAY CO.:
  Palmer, G. W., Jr., Electrical Engineer,
  Holst, E. W., Superintendent of Equipment,
  Welsh, P. S.
BOSTON & WORCESTER STREET RAILWAY CO.:
  Ayres, M. V., Electrical Engineer,
  Wadsworth, W. H., Master Mechanic.
BOSTON ELEVATED RAILWAY CO.:
  *Corning, John W., Electrical Engineer,
  Leary, W. J., Inspector Rolling Stock,
  Scott, P., Inspector Rolling Stock.
BRIDGETON & MILLVILLE TRACTION CO.:
  Sharp, A. M., Master Mechanic,
  Duffield, Charles F., Engineer,
  Way, A. P., Engineer,
  Meyers, W. H.
CAPITAL TRACTION CO.:
  *Harper, J. W., Master Mechanic,
  *Morrill, Flavius, Roadmaster.

*Delegates of Member Companies* — (Continued).

CENTRAL PENNSYLVANIA TRACTION CO.:
Rexroth, A. F., Master Mechanic,
Gerhart, P. Frank, Electrician,
Pratt, Mason B.

CHICAGO & JOLIET ELECTRIC RAILWAY CO.:
Kibbe, A. S., Chief Engineer.

CHICAGO & MILWAUKEE ELECTRIC RAILROAD CO.:
Smith, L. L., Master Mechanic.

CLEVELAND ELECTRIC RAILWAY CO.:
Tilton, B. E., Engineer Maintenance of Way,
Scullin, T., Master Mechanic,
Rifenbrick, R. B., Consulting Engineer.

COLUMBUS RAILWAY & LIGHT CO.:
Ackerman, E. O., Engineer Maintenance of Way.

CONCORD, MAYNARD & HUDSON STREET RAILWAY CO.:
Persons, Fred. A., Assistant Electrician,
Ogden, Fred. S., Master Mechanic,
Hammond, Horace N., Track Master.

CONNECTICUT COMPANY, THE:
Harte, Charles Rufus, Consulting Engineer,
Ryden, Ely W. T., Engineer,
Cram, R. C., Assistant Engineer,
Blanchard, A., Superintendent of Shops,
Symonds, C. S., Master Mechanic,
Benze, H. A.

EASTON TRANSIT CO.:
Jenkins, C. E., Engineer Maintenance of Way,
Roberts, C. F., Master Mechanic.

EAST ST. LOUIS & SUBURBAN RAILWAY CO.:
Merker, H. F., Acting Engineer Maintenance of Way.

ELGIN & BELVIDERE ELECTRIC CO.:
Weston, Geo., Chief Engineer.

FAIRMONT & CLARKSBURG TRACTION CO.:
Purinton, A. J., General Manager.

FONDA, JOHNSTOWN & GLOVERSVILLE RAILROAD:
Bagg, F. A., Chief Engineer.

FORD, BACON & DAVIS COMPANIES:
Sawyer, W. H., Engineer.

GEORGIA RAILWAY & ELECTRIC CO.:
Redding, S. A., Electrical Engineer,
Moore, A. M., Master Mechanic,
Glenn, W. H., Superintendent Maintenance of Way.

GRAND RAPIDS RAILWAY CO.:
Roderick, T. C., Assistant Superintendent,
Lynch, Daniel, General Shop Foreman.

GROTON & STONINGTON STREET RAILROAD:
**Noyes, Ira C.**

*Delegates of Member Companies* — (Continued).

ILLINOIS CENTRAL TRACTION CO.:
    Hoagland, H. C., Chief Engineer.

INDIANA UNION TRACTION CO.:
    Sparks, W. C., Superintendent of Roadway,
    Taylor, R. C., Superintendent of Motive Power.

INTERNATIONAL RAILWAY CO.:
    Harvey, G. A., Electrical Engineer,
    *Evans, W. H., Master Mechanic,
    Clark, Charles H., Engineer of Way,
    Mack, H. L., Superintendent of Electric Lines.

INTER-UUBAN RAILWAY CO.:
    Cummins, F. S., Chief Engineer.

JOLIET & SOUTHERN TRACTION CO.:
    Fisher, L. D., Chief Engineer.

KNOXVILLE RAILWAY & LIGHT CO.:
    *Mitchel, P. E., General Superintendent,
    Flood, J. F., Engineer.

LEHIGH VALLEY TRANSIT CO.:
    *Yount, J. M., Engineer.

LEXINGTON RAILWAY CO.:
    MacLeod, George, Chief Engineer,
    McClaren, G., Engineer.

LITTLE ROCK RAILWAY & ELECTRIC CO.:
    Tunnah, W. J., Master Mechanic.

MAHONING & SHENANGO RAILWAY & LIGHT CO.:
    Thompson, S. B., Master Mechanic.

MEMPHIS STREET RAILWAY CO.:
    McWhorter, A. D., Master Mechanic.

MICHIGAN UNITED RAILWAYS CO.:
    Kries, J. A., Jr., Chief Engineer,
    Bushong, A. T., Engineer Maintenance of Way.

MILLVILLE TRACTION CO.:
    Straub, Jacob E., Master Mechanic.

MILWAUKEE ELECTRIC RAILWAY & LIGHT CO., THE:
    *Simmons, F. G., Superintendent of Construction and Maintenance of Way,
    *Olds, E. W., Master Mechanic and Superintendent of Rolling Stock,
    Mullett, H. A., Superintendent of Rolling Stock,
    Atkin, J. H.

MOBILE LIGHT & RAILROAD CO.:
    Coffin, S. M., Master Machanic.

NASHVILLE RAILWAY & LIGHT CO.:
    Swint, George, Master Mechanic.

NEW YORK & QUEENS COUNTY RAILWAY CO.:
    Banghart, C. H., Master Mechanic.

*Delegates of Member Companies* — (Continued).

NEW YORK CITY RAILWAY CO.:

Wilder, C. W., Assistant Engineer,
Coleman, E. J., Superintendent.

NORFOLK & PORTSMOUTH TRACTION CO.:

Ely, E. E., Chief Engineer of Construction,
*Longmire, E. A., Master Mechanic.

PEOPLES' RAILWAY CO.:

Wilson, L. M., Master Mechanic.

PHILADELPHIA RAPID TRANSIT CO.:

Twining, W. S., Chief Engineer,
*Nichols, H. B., Engineer of Way,
*Taylor, Geo. B., Assistant Engineer,
*Heywood, James, Superintendent of Lines and Cables,
Gilmore, Edward E, Assistant Superintendent of Lines and Cables,
Hewitt, Charles, Superintendent of Motive Power,
Oliver, R. G., Master Mechanic,
Manix, M., Engineer,
Shepard, R. K., Engineer,
*Voynow, C. B., Engineer,
Kerr, W. C., Assistant Engineer,
Ier, D. W., Engineering Department,
Bransom, H. ,Shop Superintendent,
Crocker, C. T., Chief Inspector,
McCoubrie, Robert, Chief Mechanical Inspector,
Longhery, J., Mechanical Inspector.
Nolan, John, Foreman Armature and Coil Department,
McDowd, H., Foreman,
Markel, John L., Test Car Operator,
Gherky, G. H.,
Nichols, H. H.

PITTSBURG & BUTLER STREET RAILWAY CO.:

*Layton, Hudson F., Chief Engineer,

PROVIDENCE & DANIELSON RAILWAY CO.:

*Thielsen, J. E., Superintendent.

PUBLIC SERVICE RAILWAY CO.:

White, M., Superintendent Maintenance of Way,
*Schreiber, M., Engineer Maintenance of Way,
Remelius, C., Superintendent of Rolling Equipment,
Dunne, E. J., Superintendent of Overhead,
Hanf, John, Master Mechanic,
Adams, T. S., Division Master Mechanic,
Connors, P. J., Division Master Mechanic,
Spencer, Paul, Consulting Engineer,
Bedwell, C. F., Engineer,
McFeeley, John, Assistant Engineer,
Dunn, T. J., Electrician,
Beatty, C. F., Superintendent of Track,

*Delegates of Member Companies* — (Continued).

PUBLIC SERVICE RAILWAY CO.—(*Continued*):
- Kane, B., General Foreman,
- Leahy, T., General Foreman,
- Lewis, F. C., General Foreman,
- Rapp, F., General Foreman,
- Ogden, J. E., Foreman,
- Remmel, L. J., Foreman,
- Clerkin, P. A., Roadmaster,
- Danks, H. L., Roadmaster,
- Gordon, F. H., Roadmaster,
- Single, J. L., Roadmaster,

RHODE ISLAND COMPANY, THE:
- Bronsdon, M. H., Chief Engineer,
- *Wright, W. D., Superintendent of Equipment,
- Purrington, H. F., Superintendent of Tracks,
- Shippen, L. A.,
- Campbell, A. L.

RICHMOND & PETERSBURG ELECTRIC RAILWAY CO.:
- Whiteley, Calvin, Jr., Chief Engineer of Way,
- Whitfield, George H., Mechanical and Electrical Engineer.

ROCHESTER RAILWAY CO.:
- Matthews, I. E., Chief Engineer,
- Cadle, C. L., Electrical Engineer,
- Maize, F. P., Master Mechanic,
- Redman, Charles M., Train and Roadmaster.

ROCKLAND, THOMASTON & CAMDEN STREET RAILWAY CO.:
- Gannett, Guy P., Engineer.

SAGINAW VALLEY TRACTION CO.:
- Weiss, William F., Master Mechanic.

SAVANNAH ELECTRIC CO.:
- DeVane, W. C., Master Mechanic.

SCHENECTADY RAILWAY CO.:
- Penoyer, B., Engineer Mainteance of Way,
- Doyle, F. J., Master Mechanic,
- Hamilton, J. T., Assistant Superintendent,
- Walsh, F., Manager of the Freight Department.

SCRANTON RAILWAY CO.:
- Kibbe, A. S., Chief Engineer,
- Ervien, J. H., Engineer.

SOUTH SHORE TRACTION CO.:
- Archibald, A. K., Engineer.

SOUTH-WESTERN TRACTION CO.:
- *Mower, S. W., General Manager.
- Roberts, D. P., Electrical Engineer.

SOUTHWEST MISSOURI ELECTRIC RAILROAD CO.:
- Gunsalus, S. W., Superintendent of Transportation,
- Pratt, E. J., Superintendent and Electrician.

*Delegates of Member Companies* — Continued).

SPRINGFIELD TRACTION CO.:
Bixby, W. A., General Manager.

STERLING, DIXON & EASTERN ELECTRIC RAILWAY CO.:
*Smith, Clement C., Vice-President.

SYRACUSE RAPID TRANSIT RAILWAY CO.:
Roundey, E. P., Engineer Maintenance of Way,
DuBois, F. M., Master Mechanic.

TOLEDO RAILWAYS & LIGHT CO.:
Ross, J. T., Chief Engineer.

TORONTO RAILWAY CO.:
Sweetlove, G. H., Engineer,
McCabe, P. H.
Howden, John W.

TWIN CITY RAPID TRANSIT CO.:
Scofield, E. H., Chief Engineer,
Wilson, George L., Engineer and Roadmaster.

UTICA & MOHAWK VALLEY RAILWAY CO.:
Harvie, W. J., Chief Engineer,
French, M. J., Engineer Maintenance of Way,
Williams, H. S., Electrical Engineer.

UNITED RAILWAYS & ELECTRIC CO. (Baltimore, Md.):
*Adams, H. H., Superintendent of Shops,
Davis, Thomas, Engineer.

UNITED RAILWAYS COMPANY OF ST. LOUIS:
O'Brien, M., Master Mechanic,
Burgess, J. E., Superintendent of Wires.
*Griffeth, Merle R.

UNITED TRACTION CO.:
Benedict, H. A., Electrical Engineer.

WASHINGTON, BALTIMORE & ANNAPOLIS ELECTRIC RAILWAY CO.:
Donovan, Henry, Engineer,
Harter, Bret.

WASHINGTON RAILWAY & ELECTRIC CO.:
Kimball, C. S., Engineer Maintenance of Way.

WHEELING TRACTION CO.:
Crawford, John H., Master Mechanic.

WILLIAMSPORT PASSENGER RAILWAY CO.:
*Herrick, C. T., Master Mechanic.

WINONA INTERURBAN RAILWAY CO.:
Sigler, Charles, Master Mechanic.

YORK STREET RAILWAY CO.:
Mayer, L. C., Chief Engineer,
Newman, F. R., Master Mechanic.

## ASSOCIATE MEMBERS IN ATTENDANCE.*

Alden, Charles A., Street Railway Engineer, Pennsylvania Steel Co., Steelton, Pa.
Bean, W. Worth, Higman Park, Benton Harbor, Mich.
Bell, Thomas K., Chief Engineer, Interstate Railways Co.
Bigelow, Charles H., Jersey City, N. J.
Blakeslee, R. B., Superintendent, Du Bois Traction Co., Du Bois, Pa.
Boyer, Warren L., Superintendent, New York Car & Truck Co., Kingston, N. Y.
Brady, Daniel M., President, Brady Brass Co., New York, N. Y,
Case, F. E., Engineer Railway Equipment, General Electric Co., Schenectady, N. Y.
Chilton, St. John, Engineer, Allis-Chalmers Co., Milwaukee, Wis.
Clapp, Howard W., Electrical Engineer, General Electric Co., New York, N. Y.
Clark, Charles S., Agent, Pennsylvania Steel Co., Boston, Mass.
Collier, Barron G., President, Street Railway Advertising Co., New York, N. Y.
Cox, Charles H., General Manager, Citizens Railway Co., Lincoln, Neb.
Crossman, T. E., 931 Seventy-third Street, Brooklyn, N. Y.
Daggett, H. C., Electrical Engineer, Salisbury & Spencer Railway Co., Salisbury, N. C.
Duffey, Edwin, Treasurer and Manager, Cortland County Traction Co., Cortland, N. Y.
Duffy, James A., Master Mechanic, Pittsburg Railways Co., Pittsburg, Pa.
Dusinberre, George B., Consulting Engineer, Cleveland, Ohio.
Emory, G. W., Assistant Engineer Maintenance of Way, Pittsburg Railways Co., Pittsburg, Pa.
Fravel, Howard, Superintendent, Trenton & New Brunswick Railroad, Trenton, N. J.
Gibbs, C. A., Civil Engineer, Pittsburg Railways Co., Pittsburg, Pa.
Green, Alfred, Mechanical Expert, Galena Signal Oil Co., Brooklyn, N. Y.
Green, Franklin C., Jr., 166 Vernon Street, Worcester, Mass.
Greenway, Bert, Assistant Engineer, Hudson Companies, New York, N. Y.
Henshaw, Frederick V., Consulting Engineer, New York, N. Y.
Herrick, A. B., Consulting Engineer, Ridgewood, N. J.
High, John W., Manager Sales Department, Pantasote Co., New York, N. Y.

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* The names of other Associate Members in attendance at the meetings of the Engineering Association Convention are given in the list of Delegates from Member Companies and are designated by means of an asterisk (*).

*Associate Members in Attendance* — (Continued).

Holmes, Garnet B., Electrical Engineer, Wellington, New Zealand.
Hyde, E. N., Sales Department, Frank H. Stewart Electrical Co., Philadelphia, Pa.
Jackson, D. C., Consulting Engineer, Boston, Mass.
Jones, P. N., Electrical and Mechanical Engineer, Pittsburg Railways Co., Pittsburg, Pa.
Junkins, S. E., Vice-President, Westinghouse, Church, Kerr & Co., New York, N. Y.
Kent, H. R., Vice-President, Westinghouse, Church, Kerr & Co., New York, N. Y.
Killeen, G. C., Master Mechanic, New Jersey & Pennsylvania Traction Co., Trenton, N. Y.
Larned, J. M., Engineer Maintenance of Way, Pittsburg Railways Co., Pittsburg, Pa.
Lawson, George, Schenectady, N. Y.
Lewis, E. S., Standard Steel Works, Philadelphia, Pa.
Loomis, Bruce E., Insurance Engineer, Fire Underwriters Electrical Bureau, New York, N. Y.
Lewis, H. O., Worcester, Mass.
Major, M. E., Superintendent, Peoples' Street Railway Co., Nanticoke, Pa.
MacAllister, Wilbur J., Assistant to President, Hummelstown & Campbellstown Street Railway Co., Hershey, Pa.
McClellan, William, Vice-President, The Campion–McClellan Co., New York, N. Y.
McClure, A. G., Engineer, American Conduit Co., New York, N. Y.
Munger, E. T., Master Mechanic, Metropolitan West Side Elevated Railway Co., Chicago, Ill.
Norris, Prof. Henry H., Cornell University, Ithaca, N. Y.
Pellissier, G. E., Engineer, Goldsmidt Thermit Co., New York, N. Y.
Reed, W., Boardman, Civil Engineer, New York, N. Y.
Richey, Prof. Albert S., Worcester Polytechnic Institute, Worcester, Mass.
Roberts, E. P., President, The Roberts & Abbott Co., Cleveland, Ohio.
Rogan, John A., Master Mechanic, Pittsburg Railways Co., Pittsburg, Pa.
Shipper, I. D., Electrical Engineer, J. G. Brill Co., Philadelphia, Pa.
Slater, F. R., Electrical Engineer, New York, N. Y.
Smith, G. J., Master Mechanic, Metropolitan West Side Elevated Railway Co., Chicago, Ill.
Stebbins, Theodore, New York, N. Y.
Stewart, John A., President, John A. Stewart Electrical Co., Cincinnati, Ohio.
Towne, Willis L., Engineer, Worcester, Mass.
Twells, H. N., Inspector, Campion–McClellan Co., Woodbury, Conn.
Vail, Carl M., Secretary and Treasurer, Westinghouse, Church, Kerr & Co., New York, N. Y.

*Associate Members in Attendance* — (Continued).

Venning, F. J., Superintendent Overhead Lines, Pittsburg Railways Co., Pittsburg, Pa.

Westinghouse, Church, Kerr & Co., Engineers, New York, N. Y. (F. B. Church.)

Weston, A. H., Mechanical Engineer, T. H. Symington Co., Baltimore, Md.

Whipple, A. L., Eastern Manager, Curtain Supply Co., New York, N. Y.

Wilson, Chester P., Superintendent, Lackawanna & Wyoming Valley Railroad Co., Scranton, Pa.

## GUESTS IN ATTENDANCE.

(Representatives of Street and Interurban Railway Companies.)

CHAUTAUQUA TRACTION CO.:
    Price, Gaylord, Master Mechanic.
CHESTER TRACTION CO.:
    Anthony, E. L., Chief Engineer.
CONESTOGA TRACTION CO.:
    Connelly, F. B., Master Mechanic.
CONEY ISLAND & BROOKLYN RAILROAD CO.:
    Van Styck, C. H., Electrical Engineer.
DELAWARE COUNTY & PHILADELPHIA ELECTRIC RAILROAD CO.:
    Rostron, J. E., Chief Engineer.
HOLYOKE STREET RAILWAY CO.:
    Chapin, G. H., Electrical Engineer.
HUDSON VALLEY RAILWAY CO.:
    Van Wirt, D. E., Chief Engineer.
INTERSTATE RAILWAYS CO.:
    Long, C. C., Engineer,
    Tyson, F. A., Engineer.
PHILADELPHIA & EASTON RAILWAY CO.:
    Steele, H. E., Master Mechanic.
PHILADELPHIA & WESTERN RAILWAY CO.:
    Davey, John, Electrical Engineer.
UNITED TRACTION CO. (Reading, Pa.):
    Bryon, Claude, Division Engineer,
    Becker, J. S., Trackmaster.

# MINUTES

OF THE

# 1907 CONVENTION.

## MONDAY AFTERNOON SESSION

OCTOBER 14, 1907.

The fifth annual meeting of the American Street and Interurban Railway Engineering Association was held at Atlantic City, N. J., October 14–16, 1907.

President H. H. Adams of Baltimore, called the meeting to order on Monday afternoon at 2:40.

**PRESIDENT ADAMS**:—Gentlemen, we are a little late in starting, but we have all been laboring under the same difficulty, in that the dining rooms at the several hotels do not open until one o'clock and it is rather difficult to get one's dinner served and come to the meeting place at the time scheduled for our opening which was two o'clock. Therefore we shall have to be excused under the circumstances.

The first order of business that we have for this afternoon is an address by the president of the American Association, Mr. John I. Beggs. I believe Mr. Beggs has been present at every meeting I have attended of our Engineering Association, and he is one of us. Therefore, it is particularly fitting that he should address us this afternoon as the president of the American Association.

### MR. BEGGS' ADDRESS.

**MR. PRESIDENT AND GENTLEMEN**:—I am sorry, gentlemen, that your president has misrepresented the character of the few words that I may have to say to you by dignifying them with the title of an address, because I do not intend to "address" you. I have come down here, as a matter, first, of duty, but, much more, a matter of pleasure and privilege, to say, "God speed" to you in the work in which you are engaged, and as president of the American Street and Interurban Railway Association.

Prior to the time when the present plan of administering the affairs of the great street and interurban railway companies was inaugurated, very much of the time of the American Association, under its former, and likewise its present title, but more particularly its former title, was taken up by discussions of subjects which are now, in my judgment, very much more intelligently and effectively considered by the Engineering Association, through its various standing committees. This of itself is of very great advantage to the American Street and Interurban Railway Association and the various companies holding membership therein, and of incalculable benefit to all the street railways of the country whether they hold membership in the American Association or not; and it is unfortunate in my judgment that all the companies throughout the country cannot be brought to realize the great advantage to themselves, as well as to us who have spent so much time in our efforts to promote the interests of these various properties throughout the country, in taking membership in these associations. I therefore trust that as the members of these various associations come in contact with the representatives, the officers or the owners of these various companies throughout the country, they will impress upon them the great advantages to be derived from membership in this association, and that by the contribution of their ideas, their experiences, and, not least, their annual dues,— though they might be small — we may be enabled to do greater and more effective work for all these companies the country over.

I do not think there is any one of the affiliated bodies of this American Street and Interurban Railway Association that is of so much importance to the public that is served as is the affiliated body to which I now have the privilege and pleasure of saying these few brief words before your regular program is taken up. Upon you devolves much of the labor and the responsibility for the method in which it is performed, its intelligence, experience and skill, upon which, in turn, are dependent the comfort and the celerity with which the members of communities will be transported from one point to another.

I have watched with a great deal of interest during the past twelve months the work and the progress that have been made by your committee on "Standards." This appealed to me strongly; it still appeals to me strongly, and will continue to do so, because I feel that you are now only making a beginning. It has been said to me within the last two or three days that you are simply doing what we have been doing in Milwaukee for several years. Well, that is commendation which is very pleasing to me. At the same time it is very gratifying to know that we are in line with what you gentlemen think is best to be done in standardizing certain appliances and methods of application to the various parts that we are compelled to use from day to day, and are using more severely from year to year.

I well remember, twelve or fifteen years ago, when it was thought that a 4-inch axle was ample for street car use, and I remember being severely criticised, nearly twenty years ago, when I strenuously arrainged the character of construction of a steel car body that was designed for double motor equipment, which we thought was of such immense capacity in those days — two 15 horse-power motors, the old No. 6 Sprague. I am now considering seriously the adoption of motors of practically 100 horse-power, four of them, under our standard city cars. That would have been thought very heavy equipment for our heaviest interurban lines a few years ago, and yet I feel that that is absolutely essential now to give that degree of comfort, safety and speed which is demanded in this rapidly moving age.

This committee on "Standardization" means more than simply a better facilitating of shop work, or track work. It means to the executives in charge of these properties the finding of a way in which to meet the commercial needs of the roads more satisfactorily. I remember very well, about eleven years ago, one of the properties with which I am connected had nearly every type of motor and every size of axle and for a good many years it took some 21 or 22 different types of brakeshoes to keep the shop running.

Now, it is much easier for us and we can work much more advantageously, when we get the type of brakeshoe down to one or two, and when the standard axle is 5 or 5.25 or 6 inches, as we may come to — say 5.25 inches, possibly, which is our standard at the present time, and has been for several years. Standardization is farther-reaching than may appear. It will enable the management to keep a larger percentage of the equipment on the street, and that is very important from an administrative standpoint. There are roads in this country though they are becoming fewer in number, that have a percentage of their equipment constantly in the shop, that would almost bankrupt a small road, or a large one either. A well run shop or road ought to have at all times at least 95 per cent. of its equipment ready to carry passengers at the congested hours, and this would be a saving in every way. That is what standardization will do.

I consider that the work that this affiliated association has to do is of vital importance to the executive heads of every company administering this class of business throughout the United States. You here are the right hands of the executive heads of our companies. If we are not able to get the intelligent and untiring interest and enthusiasm of the men who are at the head of our shops and roadways, it is almost impossible for us to make a success of the administration, and there is so much at stake in these days.

On every street corner, in every legislative body, there are people who are conjuring up imaginary ills that they are supposed to suffer because of the manner in which these public utilities are being operated — and, as I consider it, unjustly so. Consequently, there is all the more reason why these utilities should be operated in such manner as not to leave even the shadow of a suspicion of a lack of intelligent administration.

I speak of this matter with considerable feeling because for the past twelve months one of the companies of which I am the head has been grilled by the Railroad Commission of Wisconsin, upon complaints entered by the common council, and later in an attempt by the city to violate a contract entered into seven and one-half years ago, whereby we agreed to the reduction of our rate of fare from a straight 5-cent fare and with no obligation on the part of the road to give any transfers at all (although they have been given to a certain extent) and with no requirement to carry free any of the police or fire department — all those things were conceded, and since that time we have been selling 25 tickets for a dollar, and six tickets for a quarter, whichever they preferred — the conductors must be equipped with both classes of tickets all the time — and to give universal transfers — notwithstanding that these great captains of industry that run our city councils thought it was incumbent upon them to obtain their constituents, in order to permit them the more advantageously to play to the galleries, to instruct their city attorney to demand a three-cent fare. In fact, they made it a two-cent fare, but the legal acumen of their attorney prevented him from attempting that. Our books were demanded. We did not resist the demand at all, although we might have done so. Our books were taken by a firm of reputable, able certified public accountants, for many months under a large corps of experts; the books of every company were thrown open and given to them entirely from the first day of January, 1897, to the 31st day of December, 1906, a period of fully ten years, in order to show whether or not the earnings were such as would give a fair return upon the capital and enable us to give a lower rate of fare to the city. And as I approach the sunset of life, at least possibly, the sunset of my career in this line of active business, it is one of the most gratifying experiences of my life that those accountants commend in the highest terms the manner in which those books were kept for the full period of ten years, never dreaming that they would ever be demanded in an investigation of that kind carried on by adverse accountants.

I am glad to be able to say, gentlemen, that after the most exhaustive examination before the Railroad Commission of the State of Wisconsin, that we came out of the ordeal fully and absolutely vindicated, and we stand better before the community now than we have stood at any time in the past 10 years, during which I had been there, and there has been little question since the time of this examination, and all that was demanded of us as the result of our investigation was that we should have to give at least as good service as we had been giving, and that, gentlemen, is the end to which we should all work, and I believe that is the earnest desire on the part of centainly 99 per cent. of all these companies in the country, to give just the best service that is practicable. I was frank to say before the

Railroad Commission that we could not promise to give the best possible service — the best possible service might be given by some one, but it could not be given by me, as that would be equivalent to giving every one a seat at all hours of the day, and that is absolutely impracticable from any point of view, because many people would not go home till morning.

Now, gentlemen, I desire to express to the officers of your association and to your various members and committees the appreciation of the president and of the members of the American Street and Interurban Railway Association for the fidelity with which this affiliated association has stood up behind the American Street and Interurban Railway Association. There has been absolute harmony. There has been no cause for friction, and no friction has occurred, and that condition I feel is absolutely essential for the maintenance of the harmonious relations existing and for a continuance of the effective work which is being done by these various associations, and I appeal to you to continue in that same line.

PRESIDENT ADAMS:— Mr. Beggs, in the name of our Engineering Association, I desire to thank you for the remarks you have made to us, and particularly for what you have said in reference to the work of our Standardization Committee. I feel that all the members of the association thoroughly appreciate what you have said.

MR. BEGGS:— I beg to be excused now, but ask the privilege of being present as an engineer, and not as president of the American Association, when the Standardization Committee makes its report.

PRESIDENT ADAMS:— Mr. Beggs, we will be very glad indeed to have you with us.

We have with us Mr. C. L. S. Tingley, President of the Accountants' Association, and we are desirous of having some good advice from the head of that association, which represents the men who are always trying to keep us straight.

## MR. TINGLEY'S REMARKS.

MR. PRESIDENT AND GENTLEMEN:— I am glad that Mr. Adams said that it would be a few words of advice, and not an address, because I am not a good hand at making addresses. The thought which was running through my mind particularly when Mr. Beggs was speaking, was as to the pulling together of the various associations and how they are all interwoven. The Accountants' Association, and the accountants of the various roads, are in rather an anomalous position. We are not a revenue producing department, nor do we build property;

in fact, we are the historians of the organization, and in order that our history may be authentic, and that it may be of value, not only to the management, but to ourselves and to you, we must have your cordial and hearty cooperation. In the companies we ask your cooperation, in order that our statistics may be worth something. As an association, our association asks your cooperation in order that the various plans which from time to time are formulated, for the betterment of the accounting, for the making of statistics more valuable, may be properly shaped up on the technical side.

As the oldest sister of this happy family, the Accountants' Association extends greetings to you this afternoon and wishes you a most successful and profitable meeting. I thank you gentlemen for the opportunity of saying a few words.

President Adams:— I wrote letters to the past presidents of our association. I thought it was only proper that we should have these past presidents with us if it were possible to get them. The only one of these gentlemen present at this meeting is our old friend Mr. Olds, of Milwaukee, and I am going to ask him to say something, as we are always glad to hear from him.

## MR. OLD'S REMARKS.

Mr. President and Gentlemen:— A few years ago at Detroit some of us boys met at one of the power houses, at a call from several master mechanics who thought it would be a good idea to have a meeting of the mechanical and electrical engineers to see what we could do toward having a meeting of our own that we might discuss matters between ourselves. From that small beginning was started this association which was finally merged into the American Association.

I had the pleasure of being your president at the meeting in St. Louis, and, as I stated then, it was one of the most enjoyable times of my life. It was pleasant to receive the support, which I received, from you, and as I look around this afternoon I see the familiar faces of quite a number of our old members and others who have come in with us. We have always done our best to make our new members feel welcome, and I am sure our president will second my welcome to you this afternoon.

Our work during the past few years, I think, has been the means of bringing results which are gratifying to our presidents and managers and, as Mr. Beggs stated, by our working together with the accountants, they are able to get out reports and statistics which show what we are doing. We wish to have these comparative statements to be able to go to our heads of departments so that we may know just what is being done, and this association is one of the best means through which these results can be accomplished. Mr. Beggs has spoken regarding the work of the Standardization Committee. That is a grand work. As we look through the program of this convention, comparing it with those of several years back, we see what wonderful progress this association has made, and it is because our president at the present time is a man who has always done a great deal of work in the interests of our association. He is a leader in the work. I expect this meeting to be the best we have ever had. At this time our program not only covers the work laid out at our first meetings, but it has been broadened, and takes into consideration the power plants and way department.

We have a large amount of work to do, but we can do it if we all work and have the interest in the matter that we should. I feel that there is no question, but that the members will take that interest. When I came last evening, and walked over to the headquarters' hotel, meeting so many who were here on Sunday evening, I began to think back to the time, a few years ago, when the first day of the meeting of the American Association had a very small attendance. The Engineering Association decided that we would have our first meeting one day in advance of the parent association. It was thought by a great many that we would not be able to hold our meeting on account of small attendance. It is pleasant to know that the boys were on hand and that our Monday meetings have always been a success, and I am pleased to see that it is so to-day. May the good work continue, and I, as one of the "has-beens," am more than pleased to meet with you this afternoon, and wish you continued success and prosperity, and will give you a helping hand to the best of my ability.

PRESIDENT ADAMS:—Mr. Olds' remarks about workers are like a boomerang. He has been one of the hardest workers we have ever had in the association.

President Adams then read the following address:

## ADDRESS OF THE PRESIDENT.

GENTLEMEN:—It is a great pleasure to attend a convention of this association in whatever city it may meet, but to be able to combine the association enjoyments with the great advantages of Atlantic City makes a very fortunate coincident. I cannot begin to mention the numerous qualifications of this delightful "City by the Sea," and I would not if I could, as there are a number of gentlemen who are only waiting the opportunity to give you all the information they have upon the subject.

This is the fifth annual convention of this association and the second to be held under its present name—the first three being held under the name of "The American Railway, Mechanical and Electrical Association."

Your executive committee has prepared a program for this meeting which covers a very broad field. This has been brought about by the assigning of committees to various subjects, in addition to having papers presented by the gentlemen who have so kindly consented to honor us.

The advantage of committee work in connection with our association has been impressed upon your executive committee even more forcibly during the past year than ever before. This year the committee on "Way Matters" was augmented by several sub-committees, which have reports to present upon important branches of the subject. The work of the Standardization Committee has also demonstrated the necessity of going further into committee work, as the subject is so broad it is necessary to sub-divide it and appoint sub-committees to handle various parts of the equipment. These sub-committees should take care of wheels, axles, brake shoes and heads, motors and various other important parts.

The practice of steam roads in this respect is to have standing committees take care of subjects of this character, and it is equally essential that this association should handle these questions in the same manner, in order to obtain the best results.

I desire to call your particular attention to the report of the Standardization Committee, but, before going into details, let me say, that, owing to pressure of business, Mr. Wallerstedt had to relinquish his duties as chairman, and it was with great regret that I accepted his resignation; Mr. Wallerstedt, however, kindly consented to remain a member of the committee. This association is greatly indebted to him for his work in the past as chairman of the committee, for under his guidance a great deal of the foundation of this report was laid. Mr. W. H. Evans was appointed chairman to fill the vacancy on July 3, 1907.

The report, as submitted by the Standardization Committee, represents the most important one which has been presented in the history of the association, and, although the work of the committee has been somewhat slow, it represents, not only the views of the operating men, but those of the manufacturers as well. Invitations were extended to the manufacturers interested to be present at committee meetings, upon which occasions all the subjects were fully discussed, and the report may be considered as having the concurrence of the manufacturers.

It shows that certain steps have been taken toward uniform practice in gearing for motors, the committee having met with a cordial response from the motor designers; and that further steps in the matter of uniform design in certain of the motor parts will be taken in time.

It is exceedingly desirable that definite action be taken on the report at this meeting, in order that a start may be made in the direction in which we have been looking for a long time, and, although the recommendations of the committee may not meet all the requirements of to-day's practice, and may not meet the ideas of all the members even for future practice, it is the earnest desire of the committee that the subject be considered as its recommendations covering the best practice. It may be necessary to add to, or deduct from them, in the future, but, with a good foundation on which to work, the matter will be comparatively simple.

The importance of the adoption of these recommendations, from a commercial standpoint alone, is very great. For example, the brake shoes and heads which are recommended will reduce, to a minimum, the number of patterns required and the stock to be carried will be decreased accordingly, as the manufacturer will be able to supply standard shoes upon short notice. Also, in good practice to-day, brake shoes are scrapped at between 40 and 50 per cent. of their original weight. With the narrow tread shoe recommended, the scrap will run from 30 to 40 per cent. Prices will also be affected as, by reducing the number of parts to be carried, the manufacturers will be able to give the consumer the benefit of lower prices.

If these recommendations are adopted, as I confidently expect them to be, it then rests with the members of the association to put them into practice by incorporating them in specifications for new work and rebuilding. In this way they can be taken hold of with the least possible expense.

In the name of this association, I desire to thank the individual members of this committee for the noble work they have done in connection with the report, and the association is particularly indebted to Mr. Evans, the chairman, for his untiring efforts in this direction. The valuable assistance and cooperation given this committee by the representatives of the manufacturers cannot be over-estimated and their efforts are fully appreciated by this association.

The report of the Standardization Committee is to be presented at the Tuesday afternoon session and a cordial invitation is extended to all railway representatives to be present and enter into the discussion of this important subject.

The report of the committee on Maintenance and Inspection of Electric Equipment covers a vast subject in a very able manner and the data presented is exceedingly valuable. The report shows the necessity for further investigation along these lines, and several standing committees should be appointed to deal with the subject in the future.

Every item of our program is worthy of special mention, but, as each speaks for itself, I will not attempt to go into further details.

In addition to what I have already said about the cooperation of the manufacturers in the work of the Standardization Committee, I wish also to add that they have rendered valuable assistance to several other committees in their work during the past year, and the officers of this association have had a number of inquiries from representatives of the manufacturers regarding the work of the association — all indicating the desire to cooperate with us. This is exceedingly gratifying as, in the problems we have to meet, a combination of ideas representing the producer and consumer usually brings a solution giving the best results. We are glad to have this cooperation and we desire the manufacturer to feel that he is welcome at our conferences; in fact, our association has a membership which is intended to encourage this feeling. I refer to the associate membership, which is open to such representatives.

In the "Question Box" there is a question that suggests to me an investigation which will be very profitable to this association. Briefly it is, What is the proper number of men to be employed in maintenance upon the various operations covered by the engineering field of railroading? Of course, conditions vary with each system, but take, as an example, the rolling stock maintenance. It is possible to obtain the number of cars and motors operated, men employed on maintenance, the car or ton-miles run and the general character of road and service; then, by making deductions and separating this data into groups, according to population or otherwise, it can be made of great value. The other branches can be treated in a similar manner. I submit this subject for the careful consideration of your next executive committee.

The Manufacturers' Association has surrounded us with a wonderful exhibition, and I understand that this Steel Pier has been the only limiting feature to the size of it. We appreciate the efforts its members have put forth in connection with these exhibits and I thank them in the name of this association.

Throughout the past year I have received great assistance and support from the executive committee and other members of this association, and I desire to take this opportunity of expressing to them my sincere thanks and appreciation of their efforts.

PRESIDENT ADAMS:— The next order of business is the annual report of the executive committee, but I think it will be in order to make an announcement or two just before that is brought up. Your executive committee, in session yesterday afternoon, considered it would be advisable if we could have some little informal gathering here so that the members of our association could get together and become better acquainted, and it was decided to hold an informal gathering this evening at the Hotel Dennis, the headquarters of our association, from 7:30 to 9:00 o'clock this evening, and at 9:00 o'clock we will adjourn for the entertainment to be given at the Marlborough-Blenheim. We will be pleased to have all the members and their wives and any friends they have with them to meet with us at that time. The executive committee also decided that an official photograph of the association might be a desirable thing to have, and arrangements have been made to have such a photograph taken tomorrow at 12 o'clock in front of the sun parlor.

The secretary then presented the report of the executive committee.

## ANNUAL REPORT OF THE EXECUTIVE COMMITTEE TO THE FIFTH ANNUAL CONVENTION.

### MINUTES OF A MEETING OF THE EXECUTIVE COMMITTEE, HELD IN THE ROOMS OF THE TRANSPORTATION CLUB AT THE MANHATTAN HOTEL, NEW YORK, N. Y., MONDAY, JANUARY 7, 1907.

Present:— H. H. Adams, President; F. G. Simmons, First Vice-President; F. N. Bushnell, F. H. Lincoln, W. T. Dougan, S. W. Mower, Secretary-Treasurer, of the Executive Committee; B. V. Swenson, H. W. Blake, C. B. Fairchild, Jr., and F. W. Lane.

The secretary read the minutes of the last executive committee meeting held in Columbus, October 14, 1906, and stated that the cash on hand at the present time amounted to $266.66.

President Adams asked Prof. Swenson to give an idea of what expenditures could be allowed for work of the Engineering Association during the ensuing year. Mr. Swenson stated that while the financial condition of the American Association during the past year had not been such as to allow of very great expenditures for committee work, he believed that considerable could be counted upon for that purpose the coming year.

The manner in which committee work should be conducted was carefully discussed, and the program for the year was proceeded with.

The following resolution to be submitted to the Claim Agents' Association was unanimously adopted:

WHEREAS, There are many mechanical details in connection with the construction and operation of electric railways which are of great importance to the claim agents of the various companies, and regarding which they may desire to suggest alterations and improvements in present practice:

*Therefore, be it resolved,* that the executive committee of the Engineering Association hereby expresses to the Claim Agents' Association its desire that this matter be given consideration at their discretion, and such suggestions made, and such action taken, as may seem desirable:

*And be it further resolved* that, in the opinion of the executive committee of the Engineering Association, this matter should come up for comprehensive consideration at a joint meeting of the associations during the 1907 convention.

It was decided that Mr. Paul Winsor be called upon to continue his paper of 1906 on the performance of gas engines.

Mr. W. W. Cole, General Manager of the Elmira Water, Light & Railway Co., of Elmira, N. Y., was chosen to prepare a paper giving the experience of that company with their gas engine installation.

Mr. F. H. Lincoln was entrusted with the responsibility of procuring an author for a paper on "Steam Turbines" and Prof. Swenson and Mr. Simmons were appointed a committee to arrange with Professor Storm Bull, of the University of Wisconsin, to prepare a paper on "Steam Turbines." The following gentlemen were selected to serve on the standing committees for the coming year:

### STANDARDIZATION.

H. Wallersedt, *Chairman,* W. H. Evans, H. A. Benedict, H. B. Fleming, J. M. Larned, C. B. Fairchild, Jr., H. W. Blake.

### MAINTENANCE OF WAY.

F. G. Simmons, *Chairman,* Thos. K. Bell, C. A. Alderman.

### MAINTENANCE AND INSPECTION OF ELECTRICAL EQUIPMENT.

John Lindall, *Chairman,* W. D. Wright, E. T. Munger, L. L. Smith.

### CONTROL.

J. S. Doyle, *Chairman,* G. J. Smith, P. N. Jones.

### INSURANCE.

R. B. Stearns.

It was left with Mr. Simmons to arrange for an author of a paper entitled "Care of Roadbed and Right-of-Way of Urban and Interurban Roads."

Mr. W. T. Dougan agreed to prepare a paper on "Rails and Joints as Affected by Travel in New York City."

The secretary of the American Association was requested to secure data on the corrugation of rails, and the chairman of the Way Committee was asked to prepare for the secretary a list of questions which would help him in securing this information; also to assign to some "Way men" the work of collecting data concerning tests on concrete ties, etc.

The secretary was instructed to correspond with the American Association and suggest that it assign the subject of "Car Cleaning" for consideration at the 1907 convention.

The subject "Open vs. Closed Terminals for Car Storage" was assigned to a committee, of which Mr. E. W. Olds was appointed chairman, with Mr. Martin Schreiber and Mr. John Hanf.

The following were appointed a committee to submit a report on "Operating and Storage Car House Designs":

F. N. Bushnell, R. C. Taylor and N. W. Graburn.

Invitations from Mr. C. B. Fairchild, Jr., to lunch at the Transportation Club; from B. V. Swenson to dine at the Engineers' Club, and from Mr. H. W. Blake to attend the theatre, were accepted.

It was the concensus of opinion that the opening session of the coming convention convene at 2 o'clock in the afternoon rather than in the morning.

The meeting adjourned at 3:30 P. M.

Respectfully submitted,
H. H. ADAMS, *Chairman.*

PRESIDENT ADAMS:— If there is no objection, the report will stand as read. The next order of business is the annual report of the Secretary-Treasurer.

## ANNUAL REPORT OF THE SECRETARY-TREASURER.

GENTLEMEN:— I respectfully submit herewith statement of the moneys received and expended during the year just ended — October 16, 1906, to October 14, 1907.

| | | |
|---|---|---|
| *Receipts.* | | |
| Cash on hand October 16, 1906 | $162 66 | |
| Received from the American Street & Interurban Railway Association | 1,250 00 | |
| | | $1,412 66 |
| *Expenses.* | | |
| Printing and stationery | $13 10 | |
| Postage | 5 00 | |
| Salaries | 500 00 | |
| Committee work | 517 33 | |
| Executive Committee expenses | 250 95 | |
| Miscellaneous | 89 70 | |
| | | 1,376 08 |
| Balance on hand | | $36 58 |

Attached hereto is a certificate of deposit from the Old Detroit National Bank, showing the amount in that bank to our credit October 12, 1907, to be $86.18 — three checks for $33.50, $5.00 and $11.10 not having reached the bank.

Respectfully submitted,
S. W. MOWER,
*Secretary and Treasurer.*

CERTIFICATE OF DEPOSIT.
OLD DETROIT NATIONAL BANK.
DETROIT, MICH., *October* 12, 1907.

This is to certify that the American Street and Interurban Railway Engineering Association has a balance with us on this date of $86.18.

Yours very truly,
(Signed) WM. H. FOWLER,
*Assistant Cashier.*

President Adams:— Our next order of business is the appointment of convention committees. I do not know of any particular committees that should be appointed, unless it is a Committee on Nominations, and the chair will appoint that committee at a later time.

The next order of business is the report of special committees, and under this head we will have, first, the report of the Committee on Control Apparatus. This committee has no report to present, but in lieu of it, I have requested two of the representatives of the manufacturers to present before the association at this time any data they may have upon the latest developments in the control situation. Mr. F. E. Case, of the General Electric Co., is one of the gentlemen, and Mr. Wm. Cooper, of the Westinghouse Co., the other. I have just received word that Mr. Cooper has been detained by an accident, and that he will not be able to be here. We regret very much to hear that. I will ask Mr. Case if he will present such matter as he has at hand.

Mr. Case then presented the following:

## RECENT IMPROVEMENTS IN CONTROL APPARATUS FOR RAILWAY EQUIPMENT.

By F. E. Case, *Engineer,*
Railway Equipment Department, General Electric Company, Schenectady, N. Y.

I have been asked to present some new features of multiple-unit and hand control, and will, therefore, describe some of the new pieces of apparatus which the company I represent has brought out since the last meeting. I appreciate this opportunity for bringing these to your attention and shall endeavor to confine myself to points of direct interest.

For some little time we have felt that the standard forms of K-type series parallel controllers were not entirely satisfactory for service operating conditions. While these controllers successfully handle the ordinary arcing and currents, if a motor or other part of the equipment becomes damaged so as to take an excessive amount of current through the controller, the capacity for disrupting arcs is exceeded and short-circuits sometimes occur. The use of higher operating voltages has also imposed a greater duty upon the platform type of controller. We have, therefore, designed a new line of cylinder controllers with improved magnetic blow-outs, which can be safely used where the voltage peaks may reach 750. The present line of controllers comprise three sizes, as follows:

The K-34 controller, which is suitable for use with either two 150-h.p. or four 75 h.p. motors rated at 500 volts.

The K-35 controller, for use with either two 100-h.p. or four 50-h.p. motors and less.

The K-36 controller, for use with two motors only of a capacity of 60-h.p. each or less.

As some of the newer railway motors are based on a horse power rating at 600 volts, the capacity of these controllers at this voltage will be correspondingly increased.

The K-34 and K-35 controllers produce the bridge connections by means of which full current is maintained through all the motors during the transition from series to parallel. The acceleration of the car will, therefore, be smoother than with the connections where the circuit was opened or one motor was shunted, and the strain on motors and gearing will be reduced. The bridge connections, however, are not produced by the K-36 controller as they were not considered so essential on small equipments and they also require a somewhat greater space, making the controller correspondingly larger.

The main operating handle in all sizes of these controllers is directly connected to the operating cylinder without the intervention of gearing. The reverse switch and handle are located at the left side of the controllers in order to permit a better arrangement of the new style of magnetic blow-out, differing from the previous K-types of controller in this respect.

In order to secure an efficient magnetic field for extinguishing the arc when operating the circuit, each controller finger — or set of fingers where several are mounted on a common base — is provided with an individual blow-out coil and arc chute. These blow-out coils are mounted on the contact finger blocks and are provided with thin steel pole pieces placed above and below the finger and additional steel plates are imbedded in the arc deflector partitions which distribute the magnetic flux across the arc chutes in a line parallel to the shaft and at right angles to the arc, thereby projecting the latter away from the cylinder and not against the division plate of the arc deflector, as in previous cylinder controllers of the K-type. This form of magnetic blow-out insures the extinction of the arc under very abnormal conditions and should reduce the burning and wear of fingers and segments to a minimum.

The K-34 and K-35 controllers provide six breaks in series when opening the circuit under ordinary conditions and in case No. 1 motor becomes grounded and short-circuits the breaks between No. 1 and No. 2 motor, there will still be four breaks in series to open the circuit. In previous controllers four breaks were provided in series under normal conditions, but a short-circuited motor might reduce this number to two and I believe that many cases of controller trouble have resulted from this cause.

In order to simplify the construction of the controllers and to eliminate, as far as possible. parts which might be a source of trouble, it was decided to abandon the connection board as used in the K-6, K-10, K-28 and similar controllers and bring the car wiring cables directly to the contact finger bases. The terminals provided are of the clamp form which does not require the use of solder and there are no set screws to injure the wire. The clamps are very accessible and the leads can be quickly connected and disconnected when desired.

Cut-out switches are located near the top of the controllers where they are more accessible and are not so exposed to the collection of dust and in consequence less trouble from short-circuiting is to be expected.

The omission of the connection board leaves additional space in the controller which has been utilized for lengthening the reversing cylinder and placing all of the contact fingers with their clamp terminals on the outer side, where they are very accessible for inspection and repair.

An improved method of securing the cylinder castings to the shaft has also been used. The shaft is of hexagonal section and is wrapped with a number of thicknesses of thin sheet insulation, which is cemented together and put under a heavy pressure to bring it to the exact dimensions required. The cylinder castings fit over this insulation and are securely held by means of steel keys the width of one of the hexagonal faces. Heavy set screws passing through bosses on the casting bear against these keys and hold them firmly. This construction provides an excellent insulation between the castings and the shaft and at the same time absolutely prevents the former from shifting. If necessary, the casings can readily be removed from the shaft and replaced by others without the use of special tools or fixtures.

## IMPROVEMENTS IN TYPE-M CONTROL.

A number of improvements have also been made in Type-M control. In order to economize in space a new form of contactor in several sizes has been designed, which is narrower than the present contactors and is also simpler in construction. This produces a heavier contact pressure than previous contactors of the same capacity without requiring any more operating current. New boxes have been designed for the new contactors in which the control circuit fuses are placed at one end, thereby simplifying the control circuit wiring. The length of the contactor box suitable for use with four 60-h.p. motors is about fifty-four inches over all, and for four 125-h.p. motors is about seventy-two inches.

There have been many discussions regarding the comparative merits of automatic and non-automatic control for street car or similar service, where great variations in load of car and conditions of track are encountered. With a current-limit set for one rate of output to the motors, it is obvious that the amount of current which will start a light car satisfactorily on a level track may not be sufficient to start the same car loaded on a grade or curve. In several instances, to overcome this objection, we have provided switches to cut out the current limit and permit a greater amount of current to flow through the motors in an emergency. This arrangement, however, makes it more difficult for the motorman to notch up without slipping the wheels, and we have, therefore, proposed the use of two relays of different current settings; one to be used for normal operation and the other to be cut in by means of a small switch when it is necessary to obtain a greater motor torque.

A radically new design of contactor for alternating current operation has been developed. This contactor has a very efficient magnet for operating it and a pressure as great as that in our direct current contactors is obtained. As a matter of fact this contactor is just as simple in construction as the latter and operates with perfect freedom from the disagreeable humming incident to most alternating current magnets. The same type of magnet is used for operating the reverser, oil switch and other devices requiring to be operated by means of magnets.

So much has previously been said about the use of contactors in conjunction with K-type of controllers, that I think there is no need of taking up time with this matter.

### NEW CIRCUIT-BREAKER.

We have developed a new electrically controlled circuit-breaker of smaller capacity than the previous one, known as the DB-105, for locating under the car. This circuit-breaker may be used with either Type-M, or cylinder platform control, and it is enclosed in an iron box to protect it from wheel wash and dirt. A small double-throw switch located conveniently near the motorman, is used for setting and tripping the circuit-breaker from the platform.

### FUSE BOXES.

The MA-11 copper ribbon fuse box used with equipments of 300 to 500 h.p., has been criticized on account of the difficulty in replacing a fuse, and to overcome this we have designed a fuse box, known as the MA-14, having a hinged lid similar to the smaller size, the MA-13. This fuse box is made of fireproof moulded insulation instead of sheet fibre.

There have been many opinions expressed regarding the proper design for a trolley base, and we have attempted to incorporate in a new base, known as the US-13, the desirable features recommended by our railway friends, and to eliminate those points which various types of trolleys in service have proved to be objectionable. The following is a brief specification:

Vertical roller bearing, comprising 31 steel rollers 0.25-in. in diameter by 5⅜ inches long; four tension springs adjusted with one screw; capacious oil well; resilient spring stop; height, 5 inches; weight, approximately 100 pounds; maximum pressure at 45 degrees, with 14-foot pole and high-speed fork and wheel, 35 pounds; the pressure increasing slightly at a lesser height and decreasing at a greater; minimum pressure at 45 degrees, with 12-foot pole and small wheel, 18 pounds.

It is believed that this trolley base is one which can be universally used for both high speed and city service with excellent results, The master mechanics of several different railways have examined this base and given favorable opinions on it.

## *Discussion of Mr. Case's Paper.*

MR. CASE:—I would suggest that if there are any men who would like to go into the details of the K-35 controller or the circuit-breakers, which I have described, they may be seen at our exhibition space, and I will be glad to go over them in detail.

PRESIDENT ADAMS:—What is the weight of this K-35 controller as compared with the K-28 type?

MR. CASE:—I have not had this particular one weighed, I regret to say, but I imagine it will weigh about 300 lb., as compared I think with 270 lb. for the K-28 type. It is about that proportion, as I recollect, but this controller, by the way, is of greater capacity, as it is large enough for four 50 h.p. motors rated at 500 volts. On a 600-volt basis, this would be 60 h.p. each, and the K-28 is limited to four 40 h.p. motors at 500 volts. This controller may be used up to 750 volts maximum, as its arc rupturing capacity is equal to that voltage.

PRESIDENT ADAMS:—Would the combined weight of two K-35 controllers, as compared with the combined weight of two K-28f controllers with the two contactors be in favor of the K-35?

MR. CASE:—Yes, probably by 100 lb.

MR. OLDS:—I had the pleasure a few weeks ago of taking a look at one the K-35 controllers. I can honestly say that I think it will be well worth a thorough investigation. The construction of the parts has been gone into in a very thorough and systematic manner, and to my mind, the mechanical as well as the electrical construction is good and very simple. It occupies a little more space, but we can well spare the space if they will give us something that will take care of the fireworks on the front platform. I would recommend each one of you to take a careful look at this controller. It is certainly a great improvement over our former "K" types.

Mr. Corning:—In connection with the subject of "Control," I would like to present some results of an investigation we have recently been making on the surface cars of the Boston Elevated Railway Co., of the adjustment of the steps on the rheostat.

Numerous cases of uneven acceleration were brought to our attention and it was thought that an investigation into the question of the adjustment of the resistance steps might prove advantageous.. A particularly bad case was noticed on a line on which we are operating 25 foot box cars equipped with 2 G. E. 58 motors and K-10 controllers, the gear ratio being such as would enable the cars to keep up a pretty high schedule speed in order not to interfere with the operation, over our lines, of the cars of a high speed interurban road.

On this equipment besides experiencing a very uneven acceleration, a great deal of trouble had been encountered with motor flashing, and consequent fuse blowing and controller short-circuits. Especially was this trouble noticed on some rather heavy grades over which this line was operated.

A recording ammeter showed that in accelerating an empty car from rest on a 5 per cent. grade with a rate of advance of the controller handle of four seconds per notch, a current peak of about 285 amperes was encountered on reaching the full multiple position of the controller. Besides this extraordinary peak the average current per motor throughout the multiple notches was much greater than it was for the series notches.

By the re-adjustment of the steps of the rheostat we were enabled to bring down this high peak to about 200 amperes and the average current per motor throughout the parallel notches was brought more nearly to the value it had throughout the series notches.

All the cars on this line have had their resistances adjusted to the new standard and the motor flashing, fuse blowing, and short-circuits in the controllers have been practically eliminated.

In talking with the motormen it was learned that it had been their practice to run quite a time on the next to the last notch in the multiple position before advancing to the last notch in order to avoid the high current peak, as they are called upon by their division superintendent to explain why fuses are blown. This practice resulted in numerous cases of burning out of grid resistances on the next to the last notch. By the re-adjustment this trouble has, of course, also been eliminated.

We have been over all of our single-, two-, and four-motor equipments and have worked up sets of standard resistance connections for each equipment of both open and closed cars, of which equipments there are some 32 varieties.

With the newer type of equipment that we have, having multiple unit control, the companies are furnishing resistance connections to go by, but in all of the older equipments it would seem that the car house foremen have made connections according to their own judgment. I mention this matter as I think it may be of interest to members of the association.

President Adams:—The remarks of Mr. Corning are exceedingly interesting, and bear directly on the subject we are all trying to get at, the best method of control, and I think that subject takes in the question of resistance connections, etc.

Mr. Coffin:—Does Mr. Corning remember the resistance he got after the tests were made?

Mr. Corning:—I have not the figures in mind just now, but we have blueprints that we have prepared showing the connections, and I think we would be glad to send copies of these blueprints to anyone interested.

Mr. Roberts:—So far as the operation of cars is concerned, and the use of controllers generally, with the better class of workmanship, the better standard of the operation of our cars, the superintendent of motive power may say that there are no really bad controllers. In reference to the paper read by Mr. Case, with special reference to his remarks about the K-28 controller, I will say that we have an equipment of, not four 40 h.p., but four 65 h.p. motors 93 Westinghouse, that have not been in the car barns for a year and ten months for repairs. These are in service with a B-8 controller. They are operated on a baggage car 52 feet long, and we have to operate that car over 13 per cent. grades, carrying loads that are simply limited by the size of the car. I believe that the secret of the successful operation of a road lies in the thoroughness of the inspection of the equipment. I am convinced that the secret of successful operation and maintenance of equipment, lies in both night and day inspection, and that in conjunction with the controllers we have heard mentioned this afternoon I believe we will get much better results, and we will also be working hand in hand with the manufacturers who are now striving so strenuously to perfect their apparatus, if we would give more care to our inspection, and if the superintendents of motive power and the master mechanics would go out to the shops at two or three o'clock in the morning, unexpectedly, and look over the work that is being done, we would have far better operation for our equipment. I find it a splendid thing to do that occasionally — it keeps the men up to the last notch, and you are then cooperating with the men who are working to perfect our apparatus. I do not wish to lay particular stress on the case just cited, that it was the Westinghouse equipment which stood for such a long length of time without attention, because we have limited cars operated by G. E. 57 machines, and in one case we have a car which has not been in the repair shop for two years and eight months. This particular type of car has no other car to relieve it, and is working every day. While I appreciate the advancement that is being made, and the great attention that the manufacturers are giving to the apparatus, I believe we can do a great deal on our part to help these men and push on the good work almost to perfection and then we will appreciate the work they are doing by the work we are doing in helping them. I am glad to know this advancement has been made. I am going to make a test of this wonderful controller, and I shall be pleased if I find it is better than the controllers I already have in use. I like to hear these sounds of advancement.

PRESIDENT ADAMS:— I can echo Mr. Robert's remarks — we are very pleased to hear of this advancement in the controller line. Our association appreciates Mr. Case's efforts in coming down here to-day with this information. If there is no further discussion on Mr. Case's paper, I am going to ask if Mr. Storer has anything to say on the subject in the absence of Mr. Cooper.

MR. STORER:— I was not aware of the fact that Mr. Cooper had been requested to make a statement in regard to control apparatus. Mr. Cooper was laid up by a bad burn on his hand about three weeks ago and has not been at the office since. I presume because of this he overlooked his engagement to present this matter to this association.

In regard to the developments in the last year in the Westinghouse Co., I would simply say we have carried on our development in the same line as was shown last year. We still have the electro-pneumatic type of multiple unit control and we are using the same contactors for both a.c. and d.c. For the d.c. work we use the battery for the valve magnets, and the same battery and valve magnet apply equally well for the a.c. The only difference between the contactors is in the blow-out, which is modified slightly for the a.c. We find the greatest advantage comes to us in the heavy pressures we are enabled to get on our contactors by use of the compressed air, and that combined with an effective blow-out makes a very good operating switch. We have installed a considerable number of equipments for the smaller size motors, chiefly quadruple 40 and 60 h.p. equipments in the last year, and are getting very good results therefrom. We look for a great increase in this particular development. We are great believers in the multiple unit equipment for not only heavy work, but for street car service as well, and look to see it put in operation in city streets more and more. I believe that train control in cities will do more to increase the capacity of the line than any other one thing. It is certain, for instance, that operating a three-car train in a city street will give a great deal more capacity than where single cars are operated. The three cars will occupy the street very little longer than a single car, and the delays at crossings will be practically one-third what they are with three single cars. I believe this will come into practice more and more. The main thing in introducing it is to get the men properly acquainted with the apparatus.

President Adams:— Are there any questions that anyone would like to ask Mr. Storer? If not, I would suggest that we proceed to the next report, that of the Committee on Maintenance and Inspection of Electrical Equipment, which will be presented by Mr. L. L. Smith.

Mr. Smith:— Mr. President, before presenting the report I would like to say that in undertaking the work of the committee, Mr. Lindall, our chairman, divided up that work into three parts. Data sheets were prepared for each of these parts, and each of the members of the committee received the replies relating to his part and worked up his portion individually. Mr. Wright had one feature, that having to do with the manufacture of coils, impregnating and shop methods in general. Mr. Munger had the care of wiring, control, equipment and inspection and I had the miscellaneous motor equipment, such as commutators, brush holders, etc. After these data sheets had been received and worked over, the committee held a meeting about a month ago, at Niagara Falls, and prepared a report which is now here in print and which I will read.

## REPORT OF THE COMMITTEE ON MAINTENANCE AND INSPECTION OF ELECTRICAL EQUIPMENT.

Your Committee on Maintenance and Inspection of Electrical Equipment begs to submit the following report:

In considering the nature of the report to be submitted your committee felt that it could best serve the interests of the association by finding out, so far as possible, the present practices in the maintenance and inspection of electrical equipment of the member companies and to point out to some extent the good and bad practices with such suggestions and recommendations for further improvement as would seem advisable.

To this end, early in the summer, there were prepared and sent out question blanks asking for considerable data and, while some of the information asked for may seem lacking in importance, it has been said to your committee that the mere endeavor to supply the information has brought to the attention of operating men conditions which otherwise would probably have gone unnoticed for some time. Your committee realizes that it is impossible to make recommendations that will fit all conditions, but, if we are to learn to shoot we must have a mark to shoot at.

The maintenance and inspection of car equipment is such an important item in the reliability of operation of a street railway system that the period of overhauling and inspection should be very carefully fixed. Too many overhaulings and inspections are not conducive to economy, while, on the other hand, too few mean many failures. There is always some one part of the equipment which requires attention more frequently than any other. A study should be made of this part and an endeavor made to improve it until it is no longer the first to need attention; then the periods of overhauling and inspection can be lengthened to meet the new conditions, etc.

## CONTROL EQUIPMENT.

In reply to the question as to the "Frequency of Inspection of Control," the answers were:

"K-Type."

| | | |
|---|---|---|
| Daily — 13 | 5th day 1 | 300 miles 1 |
| 2d day 1 | 7th day 8 | 500 miles 1 |
| 3d day 7 | 14th day 2 | |

"Multiple Unit Type."

| | |
|---|---|
| Daily — 1 | 500 miles 1 |
| 3d dav 1 | 1000 miles 1 |
| 7th day 1 | 1200 miles 1 |

It is evident from the above that, notwithstanding the varying conditions, some are inspecting unnecessarily often while others are not giving sufficient attention to the matter.

Your committee recommends that the control equipment of the "K-type" be given a thorough overhauling for every 60,000 miles of service as follows:

Controller should be taken apart, thoroughly cleaned, defective parts replaced, wood scraped and shellaced and other parts of the controller painted with insulating paint. The controller should then be given a break-down test of not less than 1500 volts a. c. for five seconds. With controllers in good condition your committee believes that periodical inspections on a basis of from 300 to 500 miles service — depending upon the conditions of operation — would be sufficient and the most economical, and desires to call attention to the importance of giving careful attention to the fit of controller and reverse handles on spindles, as a loose fitting control handle will sometimes make it impossible to make the proper contact on the last point. It also renders the pointer useless as an indicator to the motorman and has a tendency to make him careless in the operation of the controller as the notches cannot be readily distinguished. A loose fitting reverse handle will sometimes prevent the reverse being thrown quickly thus being the means of causing an accident when an endeavor is being made to stop the car with the reverse.

## MULTIPLE UNIT CONTROL M-TYPE.

Your committee recommends an overhauling on a 60,000 mile-basis as follows:

All coils removed from the contactor, reverser and circuit-breaker boxes thoroughly cleaned and painted with an insulating paint. Interior of boxes cleaned and painted; contact strips between coil frames inspected for loose contacts; all working parts thoroughly inspected and worn parts replaced where necessary; wires inside of contact box thoroughly painted and when reassembled given an insulation test of 1500 volts a.c. It would then seem to your committee that periodical inspections on a basis of from 600 to 900 miles of service would be satisfactory.

As the experience of some of the operating companies with this type of equipment is rather limited the following points are suggested as requiring attention at such times.

Examine for broken shunt straps and broken hinge pins.

See that interlocks are properly adjusted and that small arcs do not form between the fingers and discs, thereby burning finger and disc, which would eventually cause a defective contact at this point and a dead car.

Clean the disc and finger with fine emery cloth.

Keep the arc chutes and plates clear of all copper caused by contactors breaking current.

See that all connections are tight.

See that springs are not broken and are in good order insuring good contact when closed.

See that plungers do not bind and that contactors break free when the current is thrown off.

Contact plates should not be worn so low that screws holding them are burned.

Blow out contactor box with compressed air.

Note condition of wiring in the box.

Clean the master control cylinder and use a small amount of vaseline on the fingers.

See that the handle is of proper fit and works perfectly free.

The adjustment of controller should be looked after very carefully as there are no adjustment screws on the contact fingers.

Note condition of throttle.

Clean throttle discs and fingers and see that adjustment nuts are not loose.

Do not clean throttle plunger unless it shows signs of sluggishness.

Great care must be taken when cleaning plunger.

Clean reverser and note adjustment and condition of plates and fingers and that the reverse throws in properly.

Use no oil or grease on contactor or reverser finger or plates.

A great deal depends on the close adjustment of interlocks.

All bearings on contactors and interlocks must be made loose.

When a contactor box becomes coated inside with a yellow coating caused by the burning of copper, short-circuits are very likely to occur if this is not cleaned off.

### MULTIPLE UNIT ELECTRO-PNEUMATIC TYPE.

Overhauling on a 60,000 mile basis is recommended as follows:

Clean the drum and adjust fingers of master switch; inspect cab switch terminals and see that they are held rigidly and no strands of wire are broken. Repair, clean and carefully adjust line relay, limit switch and battery relay. Limit switch should be adjusted with ammeter. Take apart, clean, scrape and shellac drums of motor cut-out switch and reverser; replace any parts that will not make the mileage and adjust the finger tension. Strip switch groups of all magnets, switch arms and moving parts, replace worn parts when necessary. Replace worn or burned arc shields; adjust all magnet valves to operate at proper voltage; replace defective shunts; adjust and clean all interlocks and interlock fingers; examine all insulation and make as good as new; examine piston leathers and see that they are flexible and replace those badly worn. Storage batteries should be cleaned of sediment and acid strength adjusted. Grid diverters should be cleaned, the insulation renewed where necessary, and all connections tightened. Control jumpers should be tested by passing seven amperes of current through them for three minutes, at the same time giving jumper the same motion that it has when in service. Clean and adjust circuit-breaker; thoroughly blow out all piping and air chambers connected with the control.

On short period inspection the following is the practice on a road having inspection periods based on a 600-mile service.

Master Switch.— Clean and lubricate every tenth inspection.

Cab Switches.— Inspect terminals each inspection day.

Close jaws of cab switch to fit tight each inspection day.

Line Relay and Limit Switches.— Clean with crocus cloth each tenth inspection.

Inspect connections each inspection day.

Motor Cut-off Switch and Reverser.— Inspect finger tension and oil drum contactor each second inspection and feel the terminals to see if the wires are O. K.

Inspect interlocks each twelfth inspection.

Oil reverser switch toggle each tenth inspection.

Circuit-Breaker and Switch Group.— Clean armature and valves each tenth inspection.

Inspect contacts each inspection day.

Clean arc chutes each inspection day.

Blow out with compressed air all switches and grid diverters each third inspection.

Inspect all grid diverter connections and oil all pistons each inspection day, see that all terminals are tight and inspect wires.

Wipe off insulators.

Inspect shunts and battery connections each inspection day.

Add distilled water to take care of evaporation when necessary.

Test specific gravity each thirtieth inspection day.

Test battery relay and inspect terminals of battery switches each inspection day.

### INSPECTION.

In reply to question as to "*Whether inspection is made by day or night?*" 20 answered by day, 7 by night, and 9 both day and night.

We believe that it is well understood that inspection made by night is less reliable and more expensive than that made by day.

Your committee would urge that very careful consideration be given this question by those doing inspection work by night. It has been found on a number of roads where at first thought it seemed impossible to have inspection done during the day that by careful study it was found possible to arrange for the work being done in the daytime, and that this has resulted in an improvement to the service as well as being more economical.

The replies to the question as to "*What determines the frequency of inspection: Whether brakes, control, commutator work or oiling?*" would indicate that on 75 per cent. of the equipment "adjustment of brakes" was the first part of the equipment requiring attention, although several companies report motor brushes and oiling as requiring first attention.

It would seem, therefore, that a satisfactory slack adjuster for brakes is very much needed in order to obtain length of service from this part of the equipment equal to that provided by the later types of electrical equipment.

### CAR WIRING.

In reply to the questions as to "*What is done to maintain car wiring in a safe condition?*" "*How do you test car wiring, including light, heat, motor wiring?*" and "*How is light, heat, motor wiring installed — in canvas hose, conduit, cleats, moulding or in transite?*"

The answers indicate a general tendency toward iron pipe conduit installation with a periodical test for insulation break-down. Your committee believes this to be the best practice but that in the rewiring of old equipment it is frequently necessary to modify this and use iron pipe conduit under the cars where exposed to wheel wash, and cabling or boxing wires in the interior of the car.

Your committee recommends that in all cases where wires are run through metal conduit before reaching the main fuse or circuit-breaker, a wire or ribbon fuse be placed on the roof of the car near the trolley of such capacity as would blow only in case of short-circuit of wires before reaching the main fuse or circuit-breaker.

One company reports the use on a large number of cars of a factory-made cable, which consists of a number of flexible insulated wires made up in cable form, the outside covering, or jacket, being made of fireproof material woven around the wires, taps being led out through the covering.

### TROLLEYS.

Replies to question "*How often do you inspect trolley apparatus?*" show that 90 per cent. inspect them daily, four every seven days, one every 10 days, two from 300 to 500 miles, and two roads report inspecting trolley wheels every trip.

This would certainly indicate that improvement tending to increase life and reduce the necessary attention is much needed. One company reports that with the use of an automatic trolley lubricator it finds it necessary to inspect trolleys only every 60 days. Another road reports that with a similar device the labor required to take care of the trolley wheels is reduced 75 per cent. and the life of the bushing is increased nearly 100 per cent. This subject, therefore, appears to your committee well worth investigating by railroads having trouble in maintaining trolley bushings.

Replies to the question "*How often do you replace trolley bushings?*" show that for light cars in city service the bushing usually lasts as long as the wheel, but with heavy equipments and high speed, the trolley bushing is the weakest part of the equipment, the wheel lasting from two to three times as long as the bushing.

Your committee would call attention to the importance of having trolley contact springs of sufficient capacity and in good order so that they will carry the current from the wheel to the harp, and thus prevent burning between bushing and spindle. Two companies report using trolley wheels without bushings.

### SAFETY DEVICES.

In the matter of safety devices for the protection of wiring and apparatus, your committee recommends the use of a fuse in addition to circuit-breaker on all equipments requiring current-carrying capacity of over 200 amperes, the fuse to be of slightly greater carrying capacity than the circuit-breaker. It would also call attention to the importance of overhead trolley cars being properly equipped with lightning arresters and that the same be periodically inspected and tested to insure their being in proper working order.

### ARMATURE REPAIRS.

The growing tendency of operating motors at high temperatures due to increased service requirements has brought to the operating men the question of making repairs with insulating material suitable for withstanding the higher temperatures.

Your committee feels that sufficient attention has not been given by operating men to the question of motor temperatures. If a motor does not melt the solder or actually get on fire, the average car barn foreman gives the matter no further consideration, whereas motor temperatures should be followed closely and where this is found to be higher than the motors were designed for, effort should be made to find the cause and remedy it.

For insulation of armature coils wound with round wire and where the ultimate temperature rise is less than 65°C., cotton-covered and varnished cambric insulation is sufficient.

Where ultimate temperature rise is 65° to 100°C., asbestos covering for the wiring is necessary.

In the use of asbestos material your committee would call attention to the vital importance of impregnation with moisture-repelling varnish.

The asbestos should be considered as a fireproof material and a good spacer rather than a good insulator.

Armature coils and especially those wound with asbestos-covered wire must be held rigidly in place in the armature core to exclude all movement or vibration in the slot or at the ends.

By some roads it is considered good practice to impregnate an armature after it is wound by heating and revolving it in an impregnating bath. The advantage of this method is improved insulation and rigidity of windings in the core. The disadvantage is the difficulty of raising a coil should it ever be necessary to patch up an individual coil.

Experiment is suggested with the use of all fireproof insulation of armature coils; that is, asbestos-covered wire; spacing and wrapping with mica and wrapping with asbestos tape. It is suggested that this process may give longer life even under moderate temperatures, than the cotton-covered, oiled-cambric wrapped coils.

### REPAIRS OF BAR WOUND ARMATURES.

Where the original equipment was bar wound it is recommended that insulation be mica, partially, if not wholly; where bars are to be replaced it is preferable to replace with bars similar to the original, that is, with insulation of mica. However, should it be necessary to repair at short notice and no mica-insulated bars are at hand, a varnished-cambric insulated bar is recommended, appreciating that the life is not as great as mica and shorter as the working temperature is higher.

Referring to the question "*What test do you give coils for short-circuits?* the replies show about an equal use of a.c. and d.c. for this test. The committee would recommend the a.c. transformer test as a very satisfactory one. For testing armature windings the usual yoke transformer test and bar to bar test are recommended. For bar wound armatures it is further recommended that a test be made by applying full load current through the brushes in their normal position on the commutator at such a frequency as to give approximately full voltage across the brushes; armatures in all cases to be outside of their frames.

Referring to the question "*What insulation test do you give armature coils?* the replies show the use of 3300 volts a.c. as maximum and

500 volts d.c. as minimum; the majority being between 1000 and 2000 volts a.c.

Your committee recommends an insulation test between windings and ground as follows:

For roads using trolley:

New armatures — 2500 volts a.c. 5 seconds.
Old armatures — 1000 volts a.c. 5 seconds.

For roads using third rail where voltage fluctuations have to be taken into consideration:

New armatures — 3000 volts a.c. 5 seconds.
Old or partly repaired armatures — 1500 volts a.c. 5 seconds.

For commutator bar to bar test and between armature coils before windings are connected we recommend:

New armatures — 220 volts d.c. 5 seconds.
Old armatures — 110 volts d.c. 5 seconds.

As to the question "*Have you any preference for rolled or drawn copper over drop-forged segments?*" in 22 reports where preference was stated, 12 favored rolled or drawn copper and ten drop-forged.

Your committee recommends for commutators hard drawn copper as possessing greater uniformity in size and hardness over the forged bars and corresponding superiority in life and service.

Your committee wishes to call attention to the importance of material and workmanship in the construction of commutators being such as to insure a solid structure which will not shrink, become loose, or get out of true.

Built-up mica is preferable for commutator segments but it is very important that the building-up should be even and compact. Assembled commutators should be baked at 230°C and compressed while hot to insure solidity, clamps being tightened before pressure is released.

The best method of maintaining sizes of armature shafts and bearings has been much discussed. To the question "*How many sizes of shaft journals on one type of armature in use?*" the replies have been:

7 report 1 size
6 report 2 sizes.
6 report 3 sizes.
2 report 4 sizes.
2 report 5 sizes.
1 reports 12 sizes.

In regard to allowable difference in diameter between sizes:

8 report 1/16-in.
5 report 1/32-in.
4 report 1/64-in.

After considerable discussion your committee has come to the conclusion that, owing to the wide variety of conditions, it is impossible to suggest any one set of standards to fit them all, and recommends that each road select such standards as best fitted for its own conditions.

Referring to questions "*Do you sleeve worn shaft journals with steel tubing?*" and "*Do you apply same hot or cold?*"

We find that the practice of sleeving worn armature shaft journals with steel tubing is becomng quite general and is, in the opinion of your committee, without doubt good practice.

With but one exception these sleeves are applied hot. Your committee recommends applying sleeves hot with an allowance of .004-in. for each inch in diameter.

Referring to the question "*Do you bore your babbitted armature bearing shells or babbitt to size?*"

While it is the general practice to bore rather than to babbitt to size, your committee suggests that possible economy and good results may be obtained by babbitting near to size and complete finish by forcing a broach or finishing plug through the shell giving a hard smooth surface.

In reply to the question "*What grade of steel wire do you use in banding armatures?*" Four use bronze wire Nos. 16 and 17, others use tinned steel wire usually No. 17, two report No. 18, and one No. 19 B. & S. gage.

There appears to be lack of sufficient attention as to the quality of the wire.

Your committee would call attention to the necessity of using a high grade of wire on high speed motors and would suggest that for motors not exceeding 75 h.p., band wire should have an ultimate tensile strength of 125,000 pounds per square inch, while for large motors operating at a maximum armature speed of 1200 revolutions per minute or upward, the band wire should have an ultimate strength of 175,000 pounds or a sufficient additional number of turns of wire of lower ultimate strength to be equivalent thereto.

Your committee would suggest, on account of higher motor temperatures, that the importance of using solder suitable to these temperatures must not be overlooked and would recommend on all motor work the use of commercially pure tin solder, owing to its high fusing point and greater reliability.

As a flux, resin dissolved in alcohol is recommended and the use of any flux containing acid or salts is condemned.

In reply to question "*Do you have evidence of old cores materially increasing armature temperature?*" replies from 9 roads were in the affirmative and 18 in the negative.

It is the opinion of your committee that this is not a serious matter and, owing to the difficulty of properly re-assembling the laminations, the advantage given by dismantling the core and re-insulating the laminations is doubtful.

Where necessary to re-assemble laminations they should be drifted and filed to make the core slots smooth and true.

In reply to question "*Do you manufacture your own field coils?*" replies from 18 roads owning 100 cars and upward showed that 17, to a greater or lesser extent, manufactured their own field coils; one did not.

In reply to question "*Do you use asbestos-covered wire for fields? If so, are you satisfied that the results obtained justify the use of asbestos-covered wire at extra cost?*" and "*What experience have you had with field coils wound with cotton-covered wire impregnated by vacuum process with solid compounds?*"

Some replies indicate the use of wire having a layer of asbestos paper and single covering of cotton, which at one time was quite extensively used. Some reports show the use of all asbestos-covered wire and the companies satisfied with it at increased cost. One road reports the ownership of a vacuum impregnating plant, using there what is known as solid compound. Although others report that they have in use fields, vacuum impregnated with solid compound, there are but two adverse reports.

It is evident that considerable is yet to be learned from actual experience as to the comparative value of field coils wound with all asbestos-covered wire and vacuum impregnated with solid compound.

Your committee recommends for fields where temperature rise will not exceed 65° that the wire be cotton-covered and coil impregnated with solid compound and wrapped with varnished cambric, further wrapped with heavy webbing and dipped in varnish.

For fields where temperature rise is 65° to 100° that the wire be asbestos-covered, and coil impregnated with solid compound and wrapped with asbestos tape, the asbestos tape also thoroughly impregnated. The above recommendation for temperatures between 65° and 100° applies to strap-wound fields, as well as those of round wire.

Replying to questions "*What test do you give field coils in shop?*" and "*What test do you give field coils in use in motor?*" reports show that a majority of the larger roads are using coil-testing instruments such as are on the market for following up the conditions of field coils. One elevated road reports the use of full load alternating current, detecting short-circuited fields by difference in temperature or by drop in voltage. One interurban road reports bridge measurements of resistance for testing fields for short-circuits or number of turns.

In the absence of better facilities the use of the ordinary field-testing instruments with induction coil and telephone ear-piece is valuable, but your committee recommends that where alternating current can be obtained it is desirable that some form of transformer test be used.

For an insulation test of fields in motor your committee recommends the same voltage of alternating current as was recommended for the test of armature as follows:

For roads using trolley:

New fields — 2500 volts a.c. 5 seconds.
Old or partially repaired — 1000 volts a.c. 5 seconds.

For roads using third rail where voltage fluctuations have to be taken into consideration.

New fields — 3000 volts a.c. 5 seconds.
Old or partially repaired — 1500 volts a.c. 5 seconds.

## AIR COMPRESSORS.

Your committee recommends that air compressors be given a thorough overhauling and test, electrically and mechanically, at intervals not exceeding 50,000 miles and periodical inspection at 1,000-mile intervals.

## MISCELLANEOUS MOTOR MAINTENANCE.

In considering the subject before it, your committee has felt that *repairs* of troubles to electrical equipment after they have occurred form only a part of its work; another part hardly less important, is to consider the *prevention* of troubles before they occur.

In seeking preventive measures, it is well to look into what our troubles really are; analyzing them, tracing cause and if possible, devising remedy. The old adage "No chain is stronger than its weakest link," finds application on many electric railways, in the car motor proving to be the weak link in the chain.

Neglect of inspection, continuous overloading, or gross abuse of equipment on the road will naturally cause motor troubles, but assuming that these conditions are obvious enough on most roads to be kept within reasonable limits, there still remain troubles which warrant study and analysis.

Inasmuch as a large portion of motor troubles occur at the commutator, the estimated causes of commutator troubles, as shown by data sheets in answer to the following questions, should be of interest.

To question "*What proportion of your commutator and brush holder troubles do you attribute to* —

"(a) Fast feeding of controller?
(b) Quality of brushes?
(c) Quality of commutator bars?
(d) Quality of commutator mica?
(e) Design of characteristics of brush holders?
(f) Other causes?"

In a number of replies these figures were omitted but from figures submitted representing all parts of the country and nearly 10,000 cars the following averages were taken, each road's figures contributing to the average in proportion to the number of cars owned.

The percentage and relative magnitude of the several causes of trouble at the commutator, are shown graphically in Fig. 1.

Referring to diagram, Fig. 1, let us following the principle laid down by Abraham Lincoln, "One thing at a time and the big things first" —and consider—

Fast Feeding of Controllers.—This is an evil which in the opinion of your committee will always exist so long as the rate of acceleration is dependent upon the judgment and thoughtfulness of the motorman. We recommended, wherever practicable the use of such automatic devices operated electrically or otherwise, as will limit to a fixed maximum the amount of current the motor may receive. Much of the fast feeding is done by motormen through thoughtlessness and not realizing its harmful effect upon the equipment. To such cases an educational effort, thorough and persistent, with the assistance and co-operation of the operating department should be made and your committee is confident that the resulting benefit will amply repay for the time and trouble expended. For interurban lines particularly there should be determined, experimentally, the distance a car will travel

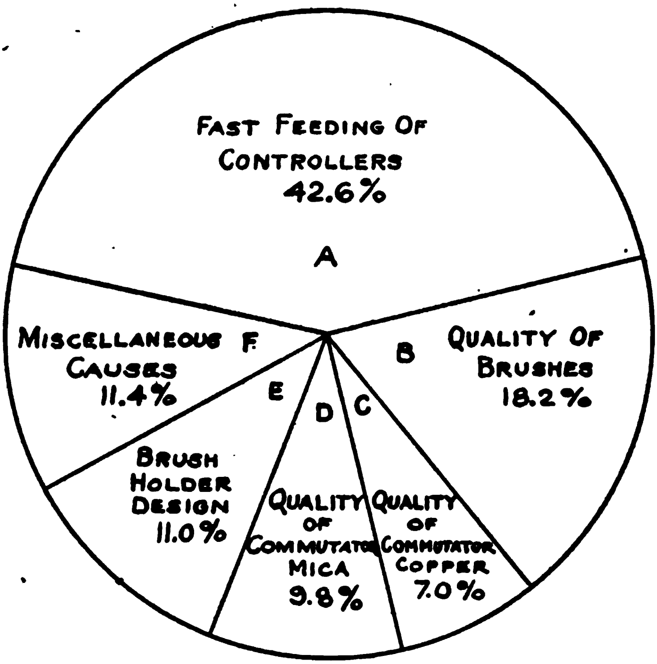


Fig. 1.—Causes of Commutator Troubles, Averaged from Data Sheets.

while building up from rest to full parallel, to receive the most rapid acceleration the motors can safely stand. This distance should be fixed as the minimum allowable, and its observance insisted upon.

Quality of Brushes.— From data received of trouble experienced with quality of brushes, one road reports no brush trouble whatever, but aside from this one exception, prevalence of brush holder trouble in some degree, appears to have been well nigh universal.

The widest variety of opinion is expressed describing the qualities of brushes most satisfactory. Regarding hardness, preferences run between soft, medium soft, medium hard and hard. Several replies in regard to hardness favor a brush hard enough to dress down the mica, but at the same time soft enough or containing graphitic or other lubricant to maintain a smooth commutator surface. Regarding price, one road uses the cheapest brush while another holds the best is none too good. Regarding the conductivity of brushes two roads prefer brushes of high resistance, one calls for a brush of low resistance and one advocates plating of brushes with copper to increase conductivity.

Regarding *specifications,* few roads have any and those submitted are of a general character calling for uniformity of size, evenness of quality, freedom from breaking and crumbling and, in general, that the brush must give satisfactory service.

In a few instances, beveled edges are advocated.

Regarding size of brushes, many replies urge the uniformity of size so that brushes shall be a good fit in the holders, not loose so as to rattle around, nor so tight as to stick.

Regarding treatment of brushes by boiling, a large proportion favor no treatment at all; 21 roads are opposed to boiling brushes in paraffine against 7 roads which favor it and two additional which favor boiling if brushes are very hard. Five roads favor boiling in oil, two in vaseline and one in soap.

Test for Brushes.— Most roads have no test other than the test afforded by everyday service while several suggest breaking the brushes, and the fracture will show the grain of the brush and whether it is homogeneous and free from lamination and hard specks to irritate the commutator.

Brushes in General.—Replies indicate the quality of brushes has caused a troublesome, and in some cases, a serious problem of maintenance and that the problem is of sufficient magnitude to warrant careful investigation and study. Your committee feels very strongly that sufficient attention has not been given by operating men or brush manufacturers to obtaining brushes suitable to the various types of motors and conditions of operation, and it recommends that the further consideration of the association be given the subject, either at the hands of a special committee, or that specialists of the manufacturing plants or research laboratories be invited to contribute papers throwing light on the only partially understood details of brush practice, pointing the way to the best and most intelligent methods.

Miscellaneous Causes.—Under this head, troubles reported form, in the aggregate, quite a feature of the total of bad results at the commutator, but no one item is pre-eminent. The troubles largely arise from local conditions of equipment and service.

The various items have been enumerated as follows:

Broken springs
Loose holders or yokes.
Weak fields.

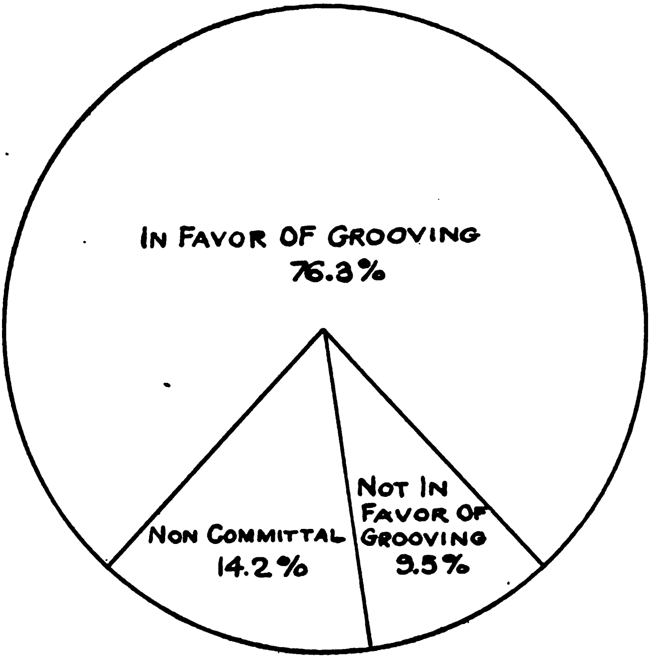


Fig. 2.—Grooving Commutator Mica, Averaged from Data Sheets.

Reversing.
Wrong setting of brushes.
Insulation of commutator core.
Electric brakes.
Carbonized string bands.

Brush holder design is a subject which your committee suggests receive the careful attention of each individual member and errors of design or workmanship which may have escaped the attention of the manufacturer, through their not having been called to his notice by the user, may be brought out and corrected. Improvements in electric machinery have been frequently made at the suggestion of the user who has constant opportunity to observe its behavior in everyday service and the progressive manufacturer is always glad to receive intelligent criticism from "the man behind the gun."

Quality of commutator mica is one of the causes which are very generally assigned for unsatisfactory results at the commutator. Interesting evidence of this is found in answer to question *"Do you consider grooving mica below the surface of the commutator effective in improving commutation?"* Expressions from 33 roads, representing 13,810 cars are as follows:

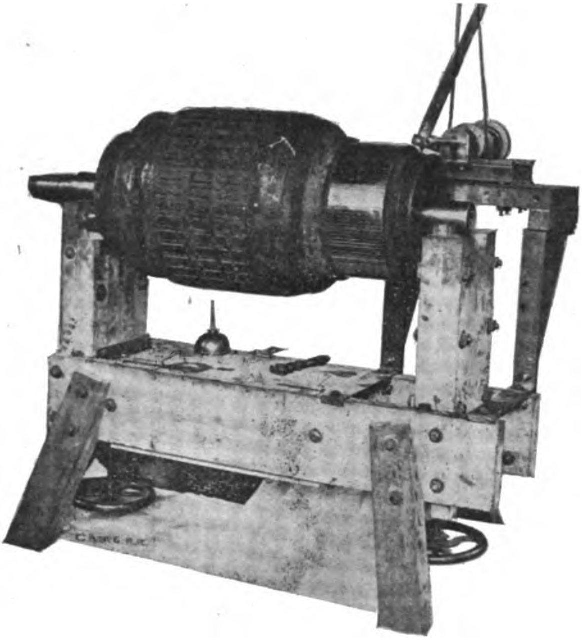


FIG. 3.— COMMUTATOR GROOVING DEVICE.

| | | |
|---|---|---|
| In favor of grooving mica... | 23 roads, or 76.3% | of cars. |
| Not in favor of grooving..... | 7 roads, or 9.5% | of cars. |
| Non-committal . . ........... | 3 roads, or 14.2% | of cars. |

These answers are represented graphically in Fig. 2.

One reply to Question No. 8 is as follows: "Yes, if using soft brushes or hard mica. Would do this more, if it were easier to do." Those who approve of grooving and are prevented by lack of convenient facilities, might look with favor upon a home-made device built at small expense, along such lines as shown in the photographs, Figs. 3 and 4.

The apparatus consists of a substantial oak armature stand with V-blocks to take the end of the armature shaft, the V-block at the commutator end is adjustable vertically by a screw attached to hand-wheel shown beneath. The V-block at the pinion end can be adjusted laterally as well as vertically.

At the commutator end is a shelf on which are two slides carrying the boxes of a buzz saw shaft. The saw is 1.25-in. in diameter, 02-in. thick and is driven at about 1000 r.p.m. The saw is fed the length of the commutator by means of a hand lever, shown. On the opposite end of the shaft from the saw is a fly-wheel. It takes about 5 minutes to set the work and 25 minutes to groove a 75 h.p. railway armature of 117 segments, making a uniformly creditable job of the grooving. The principle of grooving mica appears to your committee to be correct and in some cases more urgent than others and recommends that in cases of high mica or troublesome commutation, a trial of grooving mica be made.

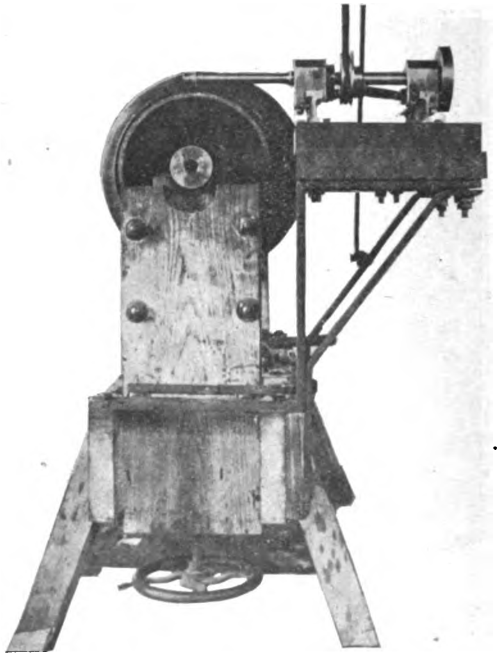


FIG. 4.— COMMUTATOR GROOVING DEVICE.

Motor Lubrication.—Reports from 34 roads show 29 lubricating on a time basis; 3 on a mileage basis and 2 on a combination of the two methods. Of the 29 roads lubricating on the time basis, the figures are not in all cases complete or definite but as nearly as may be determined the periods between lubrication are shown in Fig. 5.

TABLE SHOWING PERIOD BETWEEN TIMES OF LUBRICATION OF 29 ROADS

| | | DAILY | 2 DAYS | 3 DAYS | 4 DAYS | 5 DAYS | WEEKLY | 10 DAYS | 2 WEEKS | 3 WEEKS | MONTHLY | 6 WEEKS | 2 MO. | 3 MO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A ARMATURE BEARINGS | OLD TYPE MOTORS | ●●●●●●● | | | | | | | | | | | | |
| | MODERN TYPE MOTORS | | ● | ●●●● | | ● | ●●● | | | | | | | |
| | OLD & NEW WITHOUT DISTINCTION | ●●●●●●●●●●●●●● | ●● | ●● | | | | | | | | | | |
| B MOTOR AXLE BEARINGS | OLD TYPE MOTORS | ●●●● | | | | | | | | | | | | |
| | MODERN TYPE MOTORS | | ● | ●● | | ● | ●● | | | | ● | | | |
| | OLD & NEW WITHOUT DISTINCTION | ●●●●●●●●●●● | ● | ● | ● | | ●● | | | | | | | |
| C TRUCK JOURNAL BEARINGS | | ●●●● | | ● | | | ●●●●●●●●●● | | ●●●● | | ●●●●●●●●●●● | | ● | |
| D AIR COMPRESSORS | | ● | | ● | | | ●●●●●●● | ●● | ●●● | ● | ●●●● | | | |
| E MOTOR GEARS | | | | | | | ●●●●●● ✖ | ● | ●●●● | | ●●●●●● | ●● | ● | ●● |

NOTE: EACH "DOT" REPRESENTS THE PRACTICE OF ONE ROAD.

✖ INSPECT EVERY WEEK. LUBRICATE WHEN NECESSARY

FIG. 5.—TABLE SHOWING PERIODS BETWEEN LUBRICATION.

Lubrication of Armature and Motor Axle Bearings.— One of the most important movements of recent years in railway motor design has been the change from the old grease cup to the waste-packed chamber for lubricating motor and axle bearings. The replies received seem to indicate that all roads have not taken full advantage of this improvement from the fact that a number of roads oil armature and axle bearings every night regardless of the fact that waste lubrication enables the period of lubrication to be extended from three to seven days with perfect safety and with a saving of both labor and lubricant. That in most cases the old design of motors required armature bearings to be oiled every night admits of but little argument, but your committee would urge that a sharp distinction be drawn between the types of lubrication, that the old type motor be oiled every night or on a corresponding mileage basis, but that the modern motor be not oiled every night merely from force of habit, but that the period be lengthened to as great an extent as true economy and the proper lubrication of the bearing will permit. For this period 1,000 miles is recommended for a fair average.

Truck Journal Lubrication.— For the interval between truck journal lubrications, most replies concentrate at the weekly and 30-day periods, both of which appeal to your committee as good practice; the weekly period for interurban and the 30-day period for city cars, or corresponding periods on the mileage basis.

Motor Gearing.— Your committee would recommend inspection of gears and pionions each 1,000 miles supplying lubricant if needed believing that a small quantity of gear grease applied frequently will insure a better economy of lubricant than heavy doses administered at long intervals.

Your committee would call attention to the higher duty required of pinion material on the larger sizes of motors, as, for instance, a 40 h.p. motor pinion has a 5-in. face while a 200 h.p. motor pinion has but 5.25-in. face. It is, therefore, of vital importance that consideration be given to pinion material being of quality suitable for the higher duty.

Mileage Versus Time Basis Governing Inspection.—Of 33 roads submitting data, 3 are governed strictly by a mileage basis, 2 used a combined time and mileage while the rest are governed by time only. There seems to be a growing tendency, however, to give importance to the mileage element and most roads keep a strict mileage record so that the mileage of any car can be readily arrived at between any two dates.

Your committee regards the miles run as a more rational measure of wear and tear on equipment requiring inspection than hours or days and that the mileage sheet in the files is a more reliable guide than the calendar on the wall. Your committee recommends that the tendency to give weight to mileage rather than to elapsed time be maintained and where consistent, carried to its logical conclusion, viz.: the mileage basis to the exclusion of the time basis.

The method of obtaining mileage is substantially uniform on the various roads. The individual mileage for each car is furnished daily from the transportation department, usually though the auditor's office, and is then transferred in the mechanical department to books, tables or charts and the total miles run from the first of the month, or first of the year, posted daily so that to obtain the mileage between any two dates becomes merely a matter of subtraction.

The intervals between motor overhauling vary as widely as do the equipments and condition of service. Seven roads have no stated time while from the rest, the general average, for interurban cars is six months; for city cars, one year.

Rules for inspection on a number of roads have been outlined on the data sheets. There is a general tendency in inspection to adopt the wise practice of specialization. The work is divided up and each man is assigned and made responsible for a certain part of the work on all cars coming under his care; for example, one man is responsible for the oiling; one man, for brushes and brush holders; and one man and helper, for brake shoes and rigging, etc. Your committee would recommend this practice and would have inspection report forms printed where the inspectors sign for each car inspected and thus place themeslves on record. In all cases records should be such as to enable the responsibility to be definitely placed and indicate when inspection and repairs were made.

In conclusion.— It has been our aim in the foregoing report to avoid exploiting the individual views of members of the committee and instead, if possible, to make the report as based on the data sheets, a composite of the best judgment of the railways of the association taken as a whole. We regret that many of the roads belonging to the association have failed to send in data sheets. However, a large number have been received, forming a representative and valuable showing, and your committee wishes to thank those members for their cooperation in furnishing the data and for the careful and painstaking manner in which it has been prepared.

Your committee desires to acknowledge and express its appreciation of the valuable assistance rendered by Messrs. E. H. Anderson, of the General Electric Company, and J. L. Davis, of the Westinghouse Electric & Manufacturing Company, in giving the benefit of their judgment and experience in the preparation of this report.

Respectfully submitted,

J. LINDALL, *Chairman.*
W. D. WRIGHT,
E. T. MUNGER,
L. L. SMITH.

*Committee on Maintenance and Inspection of Electrical Equipment.*

## *Discussion of the Report of the Committee on Maintenance and Inspection of Electrical Equipment.*

President Adams:— Gentlemen, there is enough in that report to take up the time of this association profitably for this whole convention; it is exceedingly valuable. For that reason, I was glad to have Mr. Smith go into the details of reading the report instead of abstracting it, as we thought of doing at first. We have now arrived at the time when we should adjourn, but as we started late I am going to ask if you will not continue our session until 5:30.

Mr. Palmer:— Mr. President, this is a very valuable report and will undoubtedly bring up a most profitable discussion. The consideration of subjects like these may be divided into two branches, the report of the committee or the original paper on the subject, and the discussion that the report or the paper brings out. Inasmuch as we have this printed report before us in concrete shape, and I suppose that we shall have the other papers printed also, I would suggest that the person in charge of the report or the author of the paper open and conduct a general discussion rather than read the report on paper already before us in print. It seems that the time might thus be more profitably occupied. Therefore, I move that the further reading of papers or reports be omitted.

President Adams:— Is the motion seconded? This particular subject was so broad that it was thought it would be difficult to abstract it. The committee has presented what it had to say in as few words as possible. At the same time, it has, as I said before, covered a vast subject. If there is any particular topic that you would like to take up for discussion I should be pleased to entertain it.

Mr Simmons:— Before proceeding with the discussion Mr. President, I think it is due the gentleman who last spoke that some explanation be made. What he evidently objects to is the time consumed in reading a report when that report is in print. I would like to say in explanation that, as I understand it, this report was printed so recently, being distributed to-day for the first time, that it was thought advisable to read it, a very few of the members would have had the time or opportunity to do so, and the reading of the report would bring points to the attention of the members, thus promoting discussion. The practice which the Engineering Association has intended to follow, was not to read reports, but to have them circulated in sufficient time to be read before the convention by each member. It has also been our practice that some one should be assigned the task of opening the discussion of a given paper, and I think the suggestion would be a good one to have that practice apply to committee reports also. It would be well to have some one who is particularly well equipped to open the discussion, assigned to that duty. The delay in getting out the papers has caused the trouble in the present instance.

President Adams:—I would like to ask the members to read over if possible, the papers which they now have for the other sessions, before coming to the meetings. If they can read them before hand it will greatly facilitate our work in regard to this very question that Mr. Simmons has brought forward, and which suggestion we should have been very pleased to have followed if it had been possible. The secretary states that he would also like to have you read the Question Box which he has so carefully compiled.

Mr. Fairchild:—Mr. President, if there is no other subject to come up in relation to this paper, I would like to ask if we could not discuss for a moment the question of Time vs. Mileage Inspection. I think there is a very strong tendency, as the committee has outlined, to go to mileage inspection. I would like to ask Mr. Smith and others present if it is possible to carry that matter still further and go to a ton mileage inspection. The heavier roads, for instance, the Interborough of New York, have adopted a ton mileage inspection, and I know a number of interurban roads in the Middle West are looking into that question with the idea of finding out if it is possible to go to a ton mileage basis for records and inspection. I would like to ask Mr. Smith if in his opinion it is possible to work out some scheme of that kind for getting even more accurate results than are afforded by the straight mileage basis.

Mr. Smith :— Mr. President, the matter of ton mileage as a basis of inspection has not been considered by the committee. If, however, there is any representative here from any road using that system, we should be very glad to hear about it.

Mr. Roberts :— Mr. President, it may seem a somewhat peculiar statement to make to say that we take about a 200 mile basis for inspection. Of course, as I understand, the term "inspection," as used by Mr. Smith, probably means "overhauling." Is that it?

Mr. Smith :— No.

Mr. Roberts :— Inspection. Well, we inspect our cars every night in the barns, and every day at the terminus for everything. That is, the man at the terminus of the road, on interurban cars, and city cars too,— we have on one section about fifty interurban cars, and we have about sixty city cars going in to Akron. We make the inspection every day. That is an inspection of the motors on the floor, and if there is any adjustment of brakes to be made, we have to do it. When I say that we operate a over 13 per cent. grade you will know what that means, and one section is subject to an ordinance which requires two stops on that grade. Now, when a car gets away from you, on a 13 per cent. grade, it means that it is just going — yet; so we have to be very careful, especially on brake inspection. Then we have a very careful inspection at night in the barn. We have selected one of the best men we have, I took him away from a day foremanship, and placed him in charge of the night inspection with the special object of having that inspection the most thorough that was possible. We cannot afford to neglect one car for brakes. We have not a road in Akron that is not operated over excessive grades. There is no place where we can afford to neglect the brakes on a car, not one road in the city or on the interurban section, and so far as I am concerned, I feel I am quite justified in maintaining that there is not too much inspection but that we should have a thorough inspection every night, because we cannot afford to neglect one single thing about our brake rigging. I do not like to boast at all, but circumstances and conditions prove that we are absolutely correct in that procedure. Our inspection is a very careful and a very responsible one made at night, and likewise every day.

President Adams:— Mr. Olds, are you doing anything on the mileage basis?

Mr. Olds:— Mr. President, I can only report progress. We are not doing it to the extent that I was in hopes we should last year. Conditions have come up that have made it practically impossible, although I am a thorough believer in mileage inspection. I am also a believer in frequent inspection. An ounce of prevention is worth a pound of cure every time.

Mr. Roberts:— Hear, Hear!

Mr. Olds:— That is one thing I believe in. Looking after your equipment, and seeing that it is in perfect condition. If a car is in that condition, it is going to stay out, and I believe in a general and thorough inspection of every car that is in regular service. A city car, particularly, at least every four months, should come into the shop; the brakes should be examined, motors opened up and every part gone over carefully. If that is done, your car is good for another four months. It costs money but it pays.

Mr. Harper:— Mr. President, we overhaul our cars frequently. We do not let them remain on the road until they are run down. We always take those in that have made the largest mileage. A certain number of cars have to come to the shop every week for a general overhauling; and the inspection at night at the barn, I suppose, will average about every fourth night, giving the barn inspector time enough to go over the whole car. Our general inspection includes overhauling, and that will average about once every six weeks. We sometimes do not have to do anything to the cars to amount to anything. At other times we catch up little troubles. In that way I think we have good results.

Mr. Evans:— I think it is very unfortunate, Mr. President, that this report could not have been prepared and circulated earlier. I think the majority of those in the rear of the room did not even have the benefit of a copy. We followed Mr. Smith as closely as we could, and from looking over the report, I think it is one of the most valuable and concise that has yet been presented to our association, in very marked contrast to the report of last year, as this shows in detail just what we can take home and start in to go to work on. This is something that we have "long sought" as the old song says, "and mourned because we found it not." I think this could be very well put in the hands of our men who have to do with the maintenance of the different equipments and that they could start with this as an elementary primer, as you might say, and get into shape to give very much better service before another year. I scarcely think it is doing the committee justice, Mr. President, to attempt any considerable discussion of their report in the limited time we have at our disposal this afternoon, but, rather, that we can take it home and thoroughly digest it at our leisure.

Mr. Olds:— Mr. President, one thing I intended to speak of while I was up. We do as much as possible of our inspection, that is frequent inspection, in the day time. There seems to be a misunderstanding as to the general inspection or general overhauling. What I had reference to when I used the term "general inspection" was the overhauling, that it should be given at least every four months. We also give the car a day inspection every fourth day, which is more thorough than can be given at night.

Mr. Harvie:— In regard to the amount of day and night inspection, there is a question I would like to ask. Has the committee any information, or can anyone give any information as to what percentage of spare equipment there should be in order to eliminate night inspection?

There were some remarks earlier in the meeting in regard to having 95 per cent. of the equipment ready for service. If that is the case, it becomes the duty of the mechanical department to do their day inspection, and repairs, with 5 per cent. of the equipment. I would like to know if that is generally considered sufficient?

President Adams:— Possibly Mr. Olds could give us some information on the question?

Mr. Olds:— We have been fortunate or unfortunate in always having to use practically every car, and the frequent inspection that I have spoken of with the overhauling once in four months enables us to keep practically every car in service. Having a car give out on the road is a bad proposition.

Another thing that I think should be followed very closely is to have all cars in service, and not allow the foreman or division superintendent to pick out certain classes of cars to run all the time as regulars, leaving the undesirable or older ones in the house. Keep the cars out; keep them moving and wear out the old ones. By so doing your equipment is in better shape. You have better service and it is reliable, that is what we are after.

In different cities I have found the condition is about like this. If you are running 100 regulars, you will need 100 extras so that about 50 per cent. of your cars are in the house during the day time except part of them for morning service and all for evening service. Now, if you handle your equipment right, the most of this inspection can be done, and the car ready for evening service. By so doing you can keep within the 5 per cent. In fact very often we have 100 per cent. ready for Sundays and busy days.

PRESIDENT ADAMS:—I think Mr. Olds' remarks have explained how the 95 per cent. is arrived at. That is a question which would vary so with different roads that it would be hard to draw a conclusion.

MR. SIMMONS:—Regarding Mr. Beggs' remarks, I want to call the attention of this meeting to the fact that he said 95 per cent. should be available for regular and *extra* service.

MR. EVANS:—I would like to ask, in reference to what Mr. Olds and Mr. Simmons have said, if that 95 per cent. is intended to cover all the equipment or simply what is in active service? For instance, what proportion is in the paint shop and what proportion is going through general overhauling?

MR. OLDS:—That is covered by your equipment. For instance, our equipment is practically all four-motor. We have 20 cars that are not four-motors for our city service, and those 20 cars are the only ones that are not used interchangeably. They are to a certain extent obsolete, but are used every day as extras. They were new eleven years ago. We hope, in the near future, to replace them with four-motor cars. I think we can afford to do it.

The four-motor equipment gives reliable service, and if you keep moving them around, you can keep your cars going. Possibly you are not handicapped in the way I am. For instance, we are taking care of a little better than 500 cars in the paint shop which will only receive 9.

MR. ROBERTS:— I find I am quite in harmony with the statement Mr. Olds has made, but as to the mode of inspection, he means the same thing that I mean when I say overhauling. The inspection I mean to refer to is the inspection in the night or in the day, but as referring to the foreman's complete inspection I have used the term "overhauling" advisedly, because I would consider it more of an overhauling than mere inspection.

MR. EVANS:— In connection with this report of the committee, I think that it possibly may not be out of place to take some action complimentary to the work which the members have performed. I feel that we are particularly indebted to them for this very concise and complete report, and if it is in order, Mr. President, I would move that the thanks of the association be extended to its members and a vote of thanks for their valuable report. If consistent, I would include in that motion that this committee, or a similar one, be continued for next year to further pursue the same topics, either as one committee, or as several, as may be determined upon.

MR. GREEN:— If that is the motion, Mr. President, I will second it.

PRESIDENT ADAMS:— Is there any discussion on that motion?

MR. SIMMONS:— Mr. President, I think that Mr. Evans' motion, in that part in which he moves for the continuation of the committee, is a matter which should be referred to the incoming executive committee for its consideration, also the possibility of amplifying the work through the committee itself, or through some other method; appointing sub-committees to take up or subdivide the vast amount of the equipment covered would probably be the thing to do.

They could extend the work and get out specifications which would be exact and definite, and which could be published and recommended as the practice of this association. The papers could then be distributed among the shop foremen in so far as they concern them, and among the inspectors and different people we have working upon certain lines of work, and would be an incalculable benefit to every member of this association. This paper itself and the value of it was brought to my attention very forcibly a few moments ago when the assistant general manager of one of the largest roads of this whole country, if not the largest,— wanted to know if he could not get copies of this paper — an indefinite number of them — right away, saying that he would take them back to his men and distribute them. Now, if we can get this paper reduced to standard specifications, precise and exact, with specifications gotten out in the form of recommendations, through the appointment of this sub-committee — I agree with Mr. Evans' motion, that this is the thing to do. I suggest a vote of thanks to the members of the committee. The association is undoubtedly indebted, greatly indebted to them, and I feel that the work should be continued through the incoming executive committee, or in any way that is proper.

Mr. Green:— I do not want to take up much time on account of the lateness of the hour.

My reason for seconding Mr. Evans' motion was, that as committees have been continued before under like circumstances, I did not see anything wrong in asking that it should be done so now.

I will explain my position in regard to the motion:

The committee has taken up the question of lubrication, for both motor and truck equipment. The question of lubrication is one of the most important in the successful operation of a railway system, and I thought that if the committee were continued for another yeear, it would have a better opportunity to gather more definite information which would enable it to present the subject in a more complete form at our next convention.

Oil lubrication of the old type motors, while it has now been used for several years, has in a great many cases proved expensive, and in fact, the cost of lubrication of the most improved type of motor, which has been designed for oil lubrication, is ofttimes far in excess of what it should be on account of the lack of knowledge of the men who are in charge of this work.

The men on some railway systems have shown vast improvement within the past three years and have made a large reduction in their cost for oil lubrication and a still larger reduction in the cost of repairs to equipment on account of being better educated in regard to this important question.

This is my reason for seconding this motion. The committee having obtained data along this line, if continued should be able to give us information which would prove valuable to all concerned.

PRESIDENT ADAMS:— There is a little misunderstanding in relation to this committee. This is a standing committee.

MR. OLDS:— That is a suggestion which I had in mind and the point I was going to make. I understood it was a standing committee. This committee should be continued from year to year, and was touched upon by Mr. Simmons. The separating of the work, or appointing the subcommittees, can be left, I think, with perfect safety to our executive committee which will apportion it to those best fitted to handle it.

MR. SCOTT:— I would like to ask you if this question will come up to-morrow for discussion?

PRESIDENT ADAMS:— This question will be closed to-night at the end of this session.

MR. SCOTT:— I want to state that on the Boston Elevated we have operated a number of lines on a mileage basis for the past year, and some longer, with good results. I would have mentioned this before, but I felt it was my duty to give way to the older members.

PRESIDENT ADAMS:— Not at all, sir. One member is equal to another here.

MR. SCOTT:— We have also done away with the night crews in most of the houses and have obtained good results.

PRESIDENT ADAMS:— I think we are a little bit out of order. We have got a particular motion before the house.

Mr. Green:— I withdraw my second to the motion.

Mr. Simmons:— I don't think the motion is necessary at all. It will have to end in the carrying of that motion.

Mr. Evans:— I supposed the discussion on the paper had about concluded. I had no intention to cut off any discussion that any one might make, although it seems to me that it is rather late to get into the game now, as Mr. Green is opening up oil lubrication. I think, Mr. President, seriously, that this committee is entitled to a vote of thanks from the association; and if consistent, I think that possibly the names which appear upon this committee should be continued next year. That, of course, is a matter to be decided by the executive committee, though it appears to me that if these gentlemen are still willing to serve, with their experience in compiling this report, they would be of great service next year.

Mr. Coffin:— I was about to say that I should like to hear more discussion on lubricating oils and bearing metal, but will now second the motion made.

President Adams:— I understand that Mr. Evans has a motion before the house which is a vote of thanks from this association to the committee for the work it has done in the past year and for this report. The committee being, of course, a standing committee, the matter of their reappointment rests with the president and the executive committee. Mr. Evans, will you state your motion again?

Mr. Evans:— I do not know as it is necessary to state the motion particularly. I simply thought that we could extend a vote of thanks to this committee for its valuable work. Since the explanation of the president, it is unnecessary to include the latter portion of the motion which I made.

(Motion seconded and carried.)

Mr. Evans:— Before we adjourn, I would like to say that copies of the report of the Standardization Committee are in the room, and those who think they will have time to read it before to-morrow afternoon, can take a copy along.

President Adams:— There is no further business and the meeting will stand adjourned until to-morrow morning at 9 o'clock.

## TUESDAY MORNING SESSION.

### OCTOBER 15, 1907.

President Adams called the meeting to order at 10 o'clock.

PRESIDENT ADAMS:— The first business this morning is the report of the Committee on Way Matters. The report of this committee is covered by various papers and reports enumerated on the program. Does Mr. Simmons, who is chairman of that committee, desire to make any remarks in opening this subject?

MR. SIMMONS:— Mr. President and gentlemen: As just stated by the president of the association, the report of the Committee on Way Matters is embodied in the various subcommittee reports, and reports of investigations carried on during the year, which are listed in the program. The Way Committee was assigned by the executive committee in the early part of this year the task of preparing two papers for presentation before the convention, one on the care of urban and interurban roadbed and track, which is at hand and has been prepared by Mr. George L. Wilson, Engineer of the Twin City Rapid Transit Co. of Minneapolis, and that paper will be presented by Mr. Wilson. The other paper, through the inability of the sub-committee to whom the task of preparing it was assigned, to have it ready for us at this meeting, is not prepared, and at the last minute we were informed that it could not be gotten ready, and it is omitted at this meeting.

The Way Committee was instructed to send out a circular letter and investigate the matter of rail corrugations. A circular letter was sent out and a tabulation of the replies has been printed and is at hand. The committee was also requested to investigate any progress that may have been made in concrete tie work, and a circular letter on this subject was sent out, but the information which we secured was so meagre that practically nothing of value has been received.

The Way Committee also appointed a sub-committee on rails which was to act in connection with the Standardization

Committee, and it has prepared what amounts practically to a report of progress, with some definite recommendations. This report will also be read during the present session. I think this is all that the Way Committee desires to say at this time, and suggest that the various papers be proceeded with according to schedule.

President Adams:— The first paper which we have this morning, then, is the paper on "Care of Electric Railway Tracks." by Mr. George L. Wilson.

Mr. Wilson then presented the following paper:

## CARE OF ELECTRIC RAILWAY TRACKS.

By George L. Wilson, *Engineer, Maintenance of Way,*
Twin City Rapid Transit Company, Minneapolis, Minn.

### Interurban Track.

The conditions of interurban roads located, as all such roads should be, on a private right-of-way, approach closely those of steam roads. Many of the methods used in steam road practice as the result of years of experience are required for electric roads.

Grading, ballasting, construction of bridges, culverts and crossings, care of roadbed and track follow the same lines. The standard works of reference on these subjects apply with slight modifications to the care of electric roads and should be diligently studied by those in charge of permanent way.

The maintenance of the earlier and cheaply built electric roads has demonstrated that it is economy to have these roads built with well ballasted track; ties and rails put in as perfect condition in regard to surface and alignment as possible. Then the object in view is to preserve them in the same condition.

Following the purpose of keeping the track in perfect condition, which includes drainage, care of switches, crossings and side-tracks, we come to the care of the right-of-way, cleaning from snow in winter, maintaining fences, public crossings and the making of the company's property attractive to the passengers.

It should be remembered that the principal business of electric roads at present, and probably for a long time, is the transportation of passengers, whose comfort and interest are constantly to be kept in mind.

The removal of rubbish, weeds and unsightly objects of all kinds, including advertising signs, from the vicinity of the tracks is a proper part of the care of the roadway.

Company property should be neatly arranged when stored and the land owned by the company along the line and at stopping places ornamented with grassy slopes, vines and shrubbery.

At terminal and waiting points there should be flower-beds and grass plots, instead of ragged grounds and piles of debris. Otherwise, waste grounds can be so improved that there is something of interest to attract the passenger's attention at every point.

This is looking some distance ahead for new lines, but it is practical to do a little, month by month, and year by year, until the right-of-way becomes a boulevard or parkway.

All passenger transportation lines find it desirable to make their routes as attractive as possible. A sloping hillside cut, may, by the proper planting of shrubs, be made beautiful with their flowers in summer and gorgeous with the autumnal foliage. A rocky bank is not of itself attractive, but partly covered with vines it becomes an interesting feature.

Steam suburban roads have done considerable along this line and the lot of the commuter has been cast in pleasant places thereby. The great trunk lines of the country are working to the same end. Through the Eastern States many of the roads pay a great deal of attention to the making of their station grounds attractive. The annual circular of a transcontinental line offering cash prizes to its station agents for the best station flower-gardens lies before the writer and is attractively illustrated and directed to "Our Fellow Workers Among the Flowers."

The aim of every electric road must be to have its patrons attracted and interested along the way that the route may seem both short and pleasant and the trip one to be repeated.

With the care of interurban track, it is proper to consider the men as well as the roadway. The growth of railroads, both steam and electric, has required more men than are to be found in the track crews. It is a fact that track labor has been recruited from the lowest paid classes with the result that ambitious workmen have largely gone into other lines.

Our first railways and public works generally were built by the sturdy Irish immigrant, who rose soon to more remunerative employment. In succession we have had Scandinavian, Italian, Austrian and Polish. To-day, the mass of employes have no apparent interest in, or regard for, the quality or amount of work they perform. In many cases the foremen and officials can only communicate with them through interpreters, and there is an absolute lack of loyalty to the interest of the employers. This must be changed if the best results are to be obtained.

It is not necessary that a track crew should be skilled mechanics, but if track, switches, frogs and all appliances are to be in the best working order, men of a fair amount of ability and some mechanical skill are required.

To obtain this end the conditions must be such that an intelligent laborer can make a decent living and have a steady income. Work should be planned so as to be distributed through the year as far as possible in order that there may be constant employment for a nucleus of good men.

Let the men from bottom to top have an interest in the results of their work and in the efficiency of the section or division where they are employed. Make them feel that it is their company and that they are a part of the whole machine. The question of keeping skilled laborers who will do good track work is at the bottom of the maintenance of track and the most difficult problem.

All interurban track should be patrolled daily, at least, and this brings us to the track-walker and his duties. This position is above that of laborer and next to that of foreman. A skilled trackman who is sober and industrious and who can be depended upon to see that splices and bolts are in adjustment, drains and culverts open, who will detect any spreading track or broken rails, see that farm gates are kept closed and stock off the track, in fact, be a general inspector and caretaker, is an important person. It is in a great measure to his fidelity that the safety of cars and passengers will be due.

## CITY TRACK.

On city tracks the care of the roadway, besides the keeping of rails, switches and curves in good order, includes more or less of cleaning, sprinkling and snow removal. In order to determine the practice of different companies and for a guide for future operation, inquiries on these subjects were sent to sixty leading companies. From their reports, the following notes have been prepared:

*Street Cleaning.*— In the matter of cleaning the space occupied by tracks on paved streets, the general practice is that the municipality bears the entire expense, as the theory is that the cars do not bring dirt onto the street and the cleaning of the entire paved roadway would have to be done and the expense borne by the city if there were no tracks.

The fact of the tracks being in the street does not entail additional expense on the city. This view has been upheld in the courts, and it appears that refuse and things left on the streets by pedestrians, teams and by storekeepers, who often dispose of litter by throwing or sweeping it into the roadway, should be taken care of by the city authorities. Inquiries on this subject were made of sixty companies in all parts of the country, and of fifty-seven replying and operating 9,570 miles of track with a tributary population of 15,121,000, it appears that forty-seven operating 7,807 miles of track, pay no part of the street cleaning expense.

In a few cities the railways bear a part of the street cleaning expense, this being done either voluntarily or by charter requirement. In these cases, it should be considered as a contribution or a part of the amounts paid by way of taxation.

The following are among the prominent companies which assist the cities in this matter:

Chicago Union Traction Co.
Chicago City Railway Co.
} Cost $123.60 per mile for cleaning and sprinkling in 1906.
South Chicago City Railway Co.

COLUMBUS.

On 79 miles of S. T. within city limits, partly on unpaved streets, cost for cleaning and sprinkling was $13,000 in 1906.

Cost per mile of S. T., $164.55.

PITTSBURG.

Company pays for proportional part of street occupied by tracks.

NEW ORLEANS.

Pays for sweeping one street only.

NEW YORK CITY.

Pays for sweeping Broadway only, from Bowling Green to 15th street.

TWIN CITY RAPID TRANSIT CO.

Pays for sweeping its track allowance in St. Paul and Minneapolis. 86.12 miles of S. T. in 1906 cost $23,475.55. Cost per mile, $272.56.

As street sprinkling is found to be carried on satisfactorily by sprinkling cars, it is believed that the cleaning of the track allowance can be done economically and satisfactorily with sweeping machinery which will take up the debris, place it in a receptacle and take it away to proper dumping grounds.

*Street Sprinkling.*— In the large majority of cities the street sprinkling is taken care of by the municipal authorities without reference to the street railways, no part of the expense being paid by the companies. Returns from 29 companies, operating 5,056 miles and having a tributary population of 10,639,000 show this condition:

Companies operating 4,500 miles sprinkle tracks only with tank cars; of these the practice is so mixed that it is difficult to know how much mileage is sprinkled. In general it appears that the more important streets are the only ones sprinkled. This is done under requirement of state law or city ordinances. The cities are required to furnish water without charge, though in some places the company is obliged to pay for the water; in one case, 6c. per mile of track.

The business of sprinkling the whole of the roadway from tank cars has been developed to quite an extent; one outside company owning cars makes contracts with cities for sprinkling the roadways and has in one state 250 miles of streets covered. The railway companies operate the cars for a price per car-mile. The authorities of the cities report that the service is very satisfactory. The railway officials report that this plan gives good results, and while the returns are small, the conditions on the whole, are satisfactory.

A number of cities pay the railway companies directly for this same kind of service. Prices received by the company for this work vary from 7c. to 17c. per car-mile, 10c. being about an average. The cost to the property owners per season is about 10c. per foot of street or 5c. per front foot.

The tank cars used are of a variety of types, from the plain rectangular box to the cylindrical steel tanks, operated either directly by gravity, or as pneumatic sprinklers, having the tank under air pressure. The capacity is from 2,500 gallons to 6,000 gallons.

Four thousand gallons will sprinkle some six miles of tracks or three miles of entire roadway. Any statements of this kind are rather indefinite depending upon so many conditions. A better idea of the work done is to say that in actual practice one car, making four trips per day, will care for eight miles of street.

While the returns for the service are small, the indirect benefits are of as much or more value. The freedom from dust, not only decreases the expense of repairs to car machinery and gives a better contact between rail and wheel, but also, by more comfortable conditions for passengers, increases the pleasure of riding and other traffic so much that managers consider the expense more than met by increased revenue.

## OIL SPRINKLING.

The use of oil for laying dust on some streets and for the roadbeds of railways has been extensively advocated. It has been tried by a number of roads. Some consider its use satisfactory, but the greater number have not put it into extensive use. The heavy asphalt oils of California appear to give the best results, while in the Central and Eastern States a so-called "Roadbed" oil prepared by the Standard Oil Company has been used, more or less experimentally, for ten or twelve years.

Among the steam roads that have used oil are: The Boston & Maine, Boston & Albany, Central Railroad of New Jersey, Long Island Railroad, Delaware & Hudson, Santa Fé, Chicago, Burlington & Quincy, Oregon Short Line, Chicago & Alton and the Southern Pacific; the latter the most extensively, having used it for five or six years on about nine hundred miles of road.

In practice the roadbed is sprinkled with about 2,000 gallons per mile for the first application. After the first dressing, the quantity may be lessened to 600 or 1,000 gallons per mile annually, though some parties claim that two applications annually are needed. The sprinkling appliances used and the process are claimed to be controlled by a Chicago firm, which charges a royalty of $10 per mile for its use for the first application; no charge being made for subsequent sprinklings.

Few electric roads have used oil. The Los Angeles Pacific reports its use on unpaved city streets and states that three coats per year are desirable. At 60 cents per barrel, the cost per mile of double track is $100. San Francisco reports its successful use on macadam streets outside the city limits. The Brooklyn Rapid Transit Company is experimenting with forty miles of track on its suburban lines on private right-of-way where the pleasure riding is very heavy and the roadbed of sandy material.

From the reports of roads using oil, it appears that managers of the steam roads, at least, do not consider its use profitable and there is no general movement to adopt it. On electric roads on private right-of-way or on macadam outside of built-up sections of cities, it may prove to be economical where the oil is obtained at a low price, especially on sandy roads leading to pleasure resorts. The accompanying memoranda in regard to the practice and cost may be of interest.

BOSTON & MAINE RAILROAD CO.

Has used oil in 1899. Covered about 400 single-track miles. Uses 2,000 to 3,000 gallons per mile. Price of oil, 2.75c. per gallon. Average cost, $100 per mile.

BOSTON & ALBANY RAILROAD CO.

Made experiments for three years, 1898–1900. Used 2,000 gallons per mile first year, 600 gallons second year, 1,000 gallons third year. Oil per gallon, 2.75c. Cost per mile of track, $80.

CENTRAL RAILROAD OF NEW JERSEY.

Will use oil on Sea Shore Line for dusty season. Use apparatus constructed at its own shops. Pay a royalty for the process.

LONG ISLAND RAILROAD CO.

Use oil on crossings. Cost, $125 per mile. Use 600-gallon tank cars. Oil costs, 2.4c. per gallon; 600 gallons used per mile. Results on cinder and gravel ballast satisfactory.

DELAWARE & HUDSON RAILROAD CO.

From 1896 to 1900 oiled road from Saratoga to Plattsburg, 188 miles. Used roadbed oil prepared by the Standard Oil Company. Price, 2.75c. to 4.75c. per gallon. For 2,000 gallons per mile cost was $100. Kept dust down, but its use has been given up; 1,000 gallons per mile every other year would be sufficient.

OREGON SHORT LINE.

Reports using a little oil on a branch line which kept down dust till track was ballasted.

BROOKLYN RAPID TRANSIT CO.

Reports that some track on private right-of-way has been sprinkled for two years. Will sprinkle forty miles in 1907. Results satisfactory.

CHICAGO & ALTON RAILROAD CO.

Use crude oil at 3c. per gallon for sprinkling road crossings only. Stone ballast on rest of road and does not need it.

SOUTHERN PACIFIC RAILROAD CO.

Has used oil for five or six years; 900 miles of track oiled. May use up to 4,000 gallons per mile. Pays $10 per mile royalty.

SAN FRANCISCO ELECTRIC RAILWAY CO.

Uses oil on macadam streets, but not inside city limits.

LOS ANGELES PACIFIC CO.

In Los Angeles on unpaved streets an occasional coat of oil is applied. Generally, oiled streets are sprinkled three times per year. Cost, $100 per mile of double track.

### SNOW REMOVAL.

The universal practice with reference to snow is to keep the tracks open for service by the use of plows and sweepers during and immediately after each snow fall. The snow thus deposited on the rest of the roadway is left, so far as it can be done, without impeding travel. At crossings and congested points in business districts all companies assist in removing snow as promptly as possible by the use of cars and teams.

When it is necessary to remove snow from roadway the companies generally pay the cities one-third or one-half the expense incurred on the whole street. In some cases the cities and railway companies divide the streets, the railways taking care of a sufficient number of them to make up the same area as their total track allowance. One company takes one side of the streets and changes sides annually. This is reported as working well in a city of 60,000 people.

*Cost.*— In many cities no separate account of this expense is kept, and owing to the fact that conditions vary so widely between southern and northern locations, no satisfactory comparison of costs is practical.

Figures given show results of:

$17.41 per mile of S. T. in a city of 175,000 with 140 miles of track in the Central States (Indianapolis) for an average winter. In Chicago, 1906–7, the cost was $41.13 per mile of S. T. for the Chicago City Railway Co., while in Milwaukee, 85 miles away, but a very small expense was incurred. Another lake city, Detroit, reports $35 per mile for an average winter. Duluth gives $45.45 for an average winter. Toronto reports on 98 miles of S. T. in 1904–5, a cost of $102.04 per mile for one-third of street area.

Providence, R. I., reports a cost of $148 per mile of single track in 1906 and 1907. Here all snow over four inches in depth is removed.

PRESIDENT ADAMS:— Gentlemen, I feel sure we all appreciate the efforts Mr. Wilson has put forth in connection with this very valuable paper, and I hope that we will have a full discussion upon it. I will ask Mr. Ackerman, Engineer of Maintenance and Way, of the Columbus Railway & Light Co., Columbus, Ohio, to open the discussion.

## *Discussion of Mr. Wilson's Paper.*

Mr. Ackerman:— One of the first things which Mr. Wilson mentions is the matter of ballast. Right in line with that is the matter of original construction. Of course, the maintenance bills for a long time after the work is put down, depend largely, and very largely, on the original construction. Too many of our companies have gone through the streets and suburbs and levelled off the ground — whatever it may be, clay, sand, or what not — and put down their construction, and where the cities require it, have put a little foundation under the pavement and laid both pavement and track. You all know the result: low joints, low tracks, freezing of the pavement and settling of the tracks. This is likewise true with the suburban tracks. I was somewhat startled, in keeping account of suburban track, to find that one line, running into the country about thirteen miles, requires a greater outlay for maintenance than does the average city tracks in paved streets, including the paving. I refer to labor and not to material. The labor bills are larger on suburban track than on the average city track.

The matter of keeping clean the right-of-way I think is very important, and Mr. Wilson has brought the matter out in good shape. When we go for a drive, we certainly select the most beautiful; when we go for a car ride we do the same thing. It is, therefore, to the advantage of every company to keep its right-of-way clean and in trim shape. Furthermore, the cleaning of vegetation from the immediate vicinity of the track, which is the universal practice of all steam lines, is not done by all electric lines. The vegetation has the effect of decaying the timber, and in that way is very detrimental. Then, again, the inferior ballast which might have been originally used — sometimes even dirt — is detrimental to the timber and any material which will not dry out readily, like sand, is very detrimental. I venture to say that the best of white oak timber will not last half as long under such conditions as it will on good ballast.

There is one point that was not touched upon which I think all of the companies should fall in line with, and that is the use of some sort of preservative on the timber. Many of us are forced to put timber in the track under conditions which are not the best, and if the timber is not treated with a preservative it decays very quickly.

Another point brought out in Mr. Wilson's paper which I think it would be well for the management of many roads to consider, and that is the matter of the track force. Most of the street railroad companies are getting the worst labor in America. We are depending upon foreign labor largely, and many of us are forced to pay smaller wages for it than the contractors who are working next to us. The steam line people employ men who are largely from the smaller villages, dividing their roads into sections, and in this way they are enabled to get a better class of labor at lower cost than are the city street railways.

In our city we recently had the Board of Public Works pass a resolution fixing the pay for labor of all city employees 25 cents a day more than our street contractors were paying. The street railroad company was paying 10 cents a day less than the contractors. You can see the natural result.

It is my opinion that the street railways should look for the best labor available, I mean that the wages should be such as to attract the best labor; certainly, the maintenance of street railways requires men of some mechanical ideas, and if you do not have them you cannot maintain your road unless you are present at and overlook every job. I have frequently gone into a street where our men had completed work and found bolts loose, bonds not replaced, some work not up to the proper elevation, pavements laid out of surface, etc., etc. So, I say, gentlemen, the matter of wages ought to be considered more carefully by our managers. I do not take this stand with a view of increasing, but of decreasing cost of maintenance by getting effective labor.

As to the point raised as to the hours of labor, we Americans are working possibly fewer hours every year. I have an Italian foreman who employs about 30 men and he pays them $1.65 a day each, or 16.5 cents an hour. While other men were paying more money to their laborers, I found that my Italians were practically loafing. They thought that they were 10 cents a day underpaid, and the result was that they gave me about 50 per cent. of their labor — that is, they were only working at about 50 per cent. of their capacity. I increased wages 10 cents a day, with the result that I got the best Italian labor in the city, and I believe I secured fully 30 to 40 per cent. more work from them. It was startling to me to see the result of the increase of 10 cents a day in the wages of these Italians. They were all anxious to get in every hour possible.

The matter of maintaining city work was brought out by this paper very nicely. I think, however, that there might be still further discussion on the matter of pavement repairs. We all know that there is a large percentage in our maintenance bills which goes to the repair of pavements. This is quite frequently caused by defective foundations, as well as the wearing of the surface. Certainly where a defective foundation exists, the pavement will go to pieces in short order. I have found it necessary to remove some old foundations that were hurriedly built and replace them with a better quality in order to reduce the maintenance bills on pavements.

I think those who use bolted joints have a great deal of trouble in the care of railway tracks. They require considerable labor to keep them in repair. I have practiced universally the plan of replacing the old, worn, and out-of-date joints with a modern style wherever the street is disturbed, but in that manner it takes a long time to entirely equip the line. However, I believe it is policy to do so. I have one line where the joints were in bad shape, and a few years ago it was electrically welded. I found that a great advantage in holding old work together.

I think this paper embraces matters which might be discussed by many of us, and a great many of the gentlemen who are present are more capable of doing this than I. However, I thank you for the privilege of being permitted to open the discussion, but I feel as though I have not been equal to the task.

President Adams:— Gentlemen, I only hope we may hear from a few more gentlemen like Mr. Ackerman on this discussion.

Mr. Clark:— I am reminded of the time of the coronation dinner in England. Mr. Dooley said they all went in according to rank — the rankest first. Here I am, the most modest. I am just going to talk along the line they did yesterday — inspect, inspect, inspect, and I am going to say, machinery, machinery, machinery. And so, instead of trying to do your work with brawn and muscle, I believe in using your brain a little, and using machinery. On a road that I was connected with we had lots of machinery, and would have had more, if I could have gotten it. We had a couple of derrick cars, two big derricks in the yard, stone crushers, and everything that went to do away with labor. I find, for instance, that a little derrick car can go out and replace a switch with about six men, the derrick car taking the whole switch out and throwing the new one in, after which it is simply bolted up and the work is done. With derricks in the yard, as we had to buy our broken stone delivered on freight cars, this was unloaded with a bucket. We had a single rope hoist grab bucket and the stone was unloaded for about a cent a ton. Of course you know by hand that that couldn't be done for less than probably 7 or 8 cents. We had a big stone crusher, so that all the old stone that was taken off the street and all that we could steal from the contractors was taken to the yard and crushed up. We didn't waste anything. With the concrete mixers — well, I have little to say on that subject. I made a mistake once and didn't get the right one.

Mr. Kirwin — I will speak for him if he isn't here — told me of a little scheme that he had for cutting the weeds along the right-of-way. He dragged 25 40-ft. chains behind a car over his right-of-way; just sends that car around over the different suburban lines, and by the time that it has gone from one end of the line to the other, the weeds are pretty well knocked out. I don't know as I know of any others just now.

Mr. Simmons:—I agree with Mr. Clark in his statement that machinery will tend largely not only to reduce the cost in track construction and maintenance, but it will also tend to make the work more exactly and carefully done, because if your machines are properly designed to do the work you are not depending on the uniformly bad judgment of the laborer and usually of the sub-foreman in charge of doing the same work by hand. But I believe in amplifying even the use of your machinery by preparing, through your office, and engineering forces, written specifications and blueprints, covering every item of your work; and that these be prepared in sufficient number that every one can be supplied with them. The division roadmaster knows what he is doing, and there is only one way to do it. If you couple these specifications with your machinery and also apply them to such work as cannot be done by machinery, I think your results will be uniform; and if the office force and the head of the department is sufficiently able, the results will be as economical as it is possible to get them.

Mr. Wilson speaks of the beautifying of the roadway; and in that connection I would like to say that we have opened in our standard classification of accounts, an account under its own number, which is described as Parking and Beautifying of Roadway, and at our various stations where there is any extra ground, we put it into a sward and plant some flowers in beds, properly arranged; and I am arranging now at one point on our system to put in some greenhouses where we will raise our own plants and shrubs to use for that purpose. We go to the extent of painting all our poles in a given way. We paint our poles white with a black base up to a certain uniform distance above the level of the rail, and it is our belief that all of this work will pay—simply from the fact that people will take a ride over one of the lines, see the little beauty places here and there, and come back saying without knowing why, that it has been an enjoyable trip. They go again, or their friends go, and in that way the people themselves promote your business. I think that feature of the care of roadway is a very important one indeed.

The question of track walkers, which Mr. Wilson took up, is also an important one. I think that, particularly as it applies to the interurban roads, the track walker proposition is a good one. We have track walkers and we are preparing for them specifications and instructions which include not only the inspection of the track and the joints and various conditions pertaining to the mechanical features, but also the closing of the gates along the right-of-way as they pass by and see places where the farmer has inadvertently left gates open; also many other things of that kind are to be included in the track walker's specifications. In this way the track walker does not become a burden, but enough important items of work are put upon him to more than warrant his wages. Each track walker carries a copy of the specifications so that the work of this force is uniformly done.

The question of paving repairs on city streets is in my opinion largely a tradition that has been handed down to us from horse car days. The present cars do not wear out the pavement, although some of our city authorities justify the placing of these repairs on the companies by saying that the tracks and joints go down and the pavement rises through frost and other things. I think all these questions would be eliminated if both the track and the pavement are laid properly; and if laid at the same time and standard specifications be followed, either Tee or any other rail may be used. I know this is heresy with a great many of our Eastern brothers; but we have proven it in the West in very many instances and we would be very glad to show tracks which have been in for many years and which are at present just as perfect as any grooved girder rail that may be shown in any other place in the country. The whole question comes back to doing the work well, doing it uniformly, and understanding the specifications. I hope this association is to go into the matter of standard specifications very thoroughly, because I think it is the key to perfection in all lines of work and is at the present time particularly applicable to the way department. I believe these departments have been run in a more haphazard fashion than the other departments of the companies. We find, or did find a few years ago, that a foreman on one class of work was doing his work one way, and the foreman in another direction was doing his work in a very different manner. The result was that different lines of work were being followed on the same system. For instance, the drainage ditches at the side of the right-of-way were two feet from the fence line in one case and four feet in another, and the result was heterogeneous. If you will prepare standard specifications as to how the ditches should be dug and send them out to the men so that every man is working absolutely with the same idea, the result is uniformity. The specifications are prepared by the office force, in consultation with the different roadmasters and combining the ideas of all of them, they are brought up to the head of the department for a final approval. After his suggestions are gone into, the specifications are gotten out, and with the necessary blueprints, are turned over to all the force, thereby insuring uniformity in results. You simply have to go out and see that the man is doing his work according to the specifications. The question of help which as we all know, is a very important one, has become also a difficult one, particularly as applied to the large cities. The padrone system among these foreign laborers is very detrimental to the securing of good work; and I believe, with some of the other speakers here, that paying the best wages that are paid to the common laborer is one of the ways to get at the matter. If you pay the highest scale of wages you will find that the laborers will prefer to work for a large corporation from whom they receive monthly checks without any difficulty, to working for ordinary city contractors, a great many of whom do not always pay, of if they do, do not pay promptly. But these people don't think very far and if your wages are a little lower than the other people they leave you and work for the contractor. If you pay at least as high wages as any of the contractors, the probabilities are you can retain a uniform class of help. On the interurban lines, I do not think that this is as hard a proposition, in that you can secure most of your help by employing the farmer boys in the small towns or villages along the lines, and by having your section gangs stationed at outlying points, you are then able to secure a far better class of labor. We help to encourage the feeling of interest in the work, which Mr. Wilson suggests, by offering to the section foremen annual or semi-annual prizes for the best showing, and this has been in effect for a couple of years past. We find that it has a very good effect among the section foremen. They compete with one another as to the general appearance of their lines, and our president and general manager, Mr. Beggs himself, participates in the inspection which decides the prizes. I think that this is leading in the right direction.

President Adams:— Mr. Simmons' remarks on the question of uniform specifications in this maintenance of way question are very pertinent. I believe it is a little difficult to hear in this room, and it will be more satisfying if the members when making remarks will try to place themselves in such a position that the stenographer and the majority of the other members in the room can hear them at the same time.

Mr. Schreiber:— Mr. Wilson's paper is interesting from the point of view of the data which is gathered on obligations of the different railroad companies as to the removal of the debris from the streets, and for sprinkling. The speaker had occasion to recently investigate the advisability of using water, oil or tar on a particular property, and it may be interesting to bring it out in connection with the paper. It was found that the cost of water, using ordinary sprinkling tanks, was about half a cent per running foot of single track per season, and from oil was three or four cents per running foot per season. Those figures for oil I think, approach those used by Mr. Wilson. And water gas tar was also investigated. This is quite a fluid material and runs readily, especially when it is distributed in the sunlight. It lends quite an asphaltic finish to a macadam paving, increases the durability to a considerable extent, and is somewhat less costly than oil. However, the water was used on account of the great advantage in cost.

I might say a word about the use of machines in connection with track work. I think that is what we are all coming to, and I don't believe there is any department of railroad service that is so far behind the times in labor saving devices as the track department. Some of the disadvantages in using track machinery on streets of cities are the trouble from interefering with traffic, noise, and the complaints of the authorities, which are serious propositions to overcome. Recently we had a concrete mixer that seemed to be very promising; but the first time it was brought out, three horses ran away, and on account of this and other complaints we were not allowed to bring the machine on the street again.

Speaking about rules, I have noticed on several roads that they have a book of rules for care of track and roadway that is distributed to the roadmasters, foremen, and subforemen. I am sure that Detroit has such a code of rules. I believe it would be an interesting subject for a special committee to work upon with the view of establishing a standard code of rules, and submit them to the association for approval. Construction could not be included very well, because each property is different; but in the maintenance and care of tracks there are a great many practises in which the mode of procedure is more or less common.

Mr. Adams:— I believe Mr. Whipple, the chairman of the Entertainment Committee, would like to make a remark or two.

Mr. Whipple:— The officers and the executive committee are asked to be present with their wives and ladies at 9 o'clock this evening at the Marlborough-Blenheim. We have tried to reach every one separately, but have not succeeded and the whole association is asked to be present. And for the theatre party to-morrow night the tickets will be distributed between the hours of eleven and one — Mary Mannering at the Savoy Theatre and the "Top o' the World" at Young's Pier Theatre. The tickets will be distributed from one of the box offices at the end of the steel pier.

Mr. Adams:— The secretary has kindly provided some attendance cards and they have been placed on the chairs in order that the members may fill them out. The official photograph will be taken at 12 o'clock. I will leave Mr. Simmons in the chair for a few minutes.

(Vice-President Simmons in the chair.)

Vice-President Simmons:— We would like to proceed with the discussion of this paper.

Mr. Reed:— I used to be a "way man." I notice that Mr. Wilson takes up the matter of snow removal. It is something that interests all city railways, and I thought it might be of interest to explain the method used in New York for the past four or five years — a system conceived by Major Woodbury, Commissioner of Street Cleaning. The matter was gone into very thoroughly by him with others who had experience in the line. For years the snow was removed from the streets both by the street railway company and the city under an agreement whereby the street railway company cleaned certain streets from building line to building line, of area equaling the area that they were under statute obliged to clean throughout the entire snow removal districts. Tickets were issued for each cartload of snow removed and a great many tickets evidently issued for snow that wasn't removed. There is no question but that there was any quantity of stealing. We tried to watch it as best we could utilizing our foremen, timekeepers, etc., to check the amount of tickets issued. Then Major Woodbury proposed paying for snow removal by cubic yard of fall. It struck me as a very fair way to get at it. It would stop entirely the matter of stealing as far as the city or the railway company was concerned; if any one got stuck it was the contractor — it was up to him. I thought it wise to have the city try the system for one or two years before we should adopt it which they did. The city paid the first year something like 27 cents per cubic yard of fall, which was equal to about 90 cents per cubic yard of snow handled — a tremendously high price. We estimated that in the city of New York the average shrinkage was somewhere between 70 and 80 per cent. The contracts for the last few years have been let for 20 cents. The railroad company was able to let the contract for from 12 to 14 cents per cubic yard of fall, and making a computation at the end of the season, we found it cost a little bit more than the old method of removing by cartload, but we had the streets cleaned; whereas by the old method, if we left so many yards of snow on the streets, so much money was saved, a temptation which the way man found hard to resist.

The better cleaning made a big improvement, not only in the running of cars, but we got the streets cleaned so we were able to get up to the full earnings in a very short time. I think it is a matter that is well worth thinking of by those who are obliged to clean any amount of streets by the contract method. In some places the railroad companies are enabled to remove snow by cars. That has seemed to be in New York up to the present time impracticable. The contract method referred to is something of a gamble. In a snowfall, when the temperature is low, 50 per cent. instead of 20 to 30 per cent. has to be carted away, and the contractor that takes it for 14 cents per cubic yard of fall loses money; whereas in a storm that comes immediately before a thaw, the contractor makes money, and in justice to the contractor, in every case where the snowfall exceeds four inches, he should be allowed for the amount of snowfall, the amount being obtained by the official reports of the Government Bureau in New York City.

VICE-PRESIDENT SIMMONS:— Gentlemen, we would like to hear any further discussion of this paper.

MR. RYDER:— There is one subject I would like to bring up for discussion and that is the question of drainage. The question of ballast has already been considered. Sometimes it is very difficult to get good ballast, but generally, on interurban work it is possible to dig a good ditch, although it is not always done. . From an operating point of view, if the ditches are dug deep enough to keep the water off the surface of the track, that very frequently seems to satisfy the operating men; but for maintenance purposes it seems to be very necessary to dig the ditches deep enough so they are at least below the bottom of the ties. When you come to city work, of course, it is out of the question to dig ditches. The question I want to raise is how far can we replace that work by laying tile drains between the tracks, if it is double track, or alongside with single track. There seems to be a good many kinds of soil which make very poor ballast if left alone; but which make very decent ballast if you take the water out of it rapidly. And sometimes that is complicated, in our eastern cities, by the fact that the sewers are on a separate system; so that it is not permissible to connect these drains directly into the sewers; where it can be done however, we usually get a connection point every few hundred feet and use small sizes of ordinary tile drains and by so doing avoid the very expensive ballast which would be necessary if you dig out below the ties. I would like to get an expression of opinion from those who have had experience as to what the position of those drains should be. In double track work we are generally laying them so that the top of the tile is about 6 inches below the bottom of the ties; and a certain amount of good ballast material is brought in to lay around the tile in the ditch. In single track work we have generally laid them alongside the track rather than under the track, with the idea that it would be easier to replace them and look after them; but of course it does not give quite as good drainage because the water has got twice as far to go to reach the pipe. We have even gone so far in some of our cities, where the conditions are the worst, as to lay a concrete foundation under the track, and then 3 or 4 inches of gravel ballast, and the ordinary cross tie and rail construction on top of that, with a tile drain in the ballast outside the ends of the ties. That was in ground which was practically brick clay and we had to take extraordinary precautions. I would like to hear very much from others who have installed such drainage as to just how they work it.

VICE-PRESIDENT SIMMONS:— I would be glad to hear something in relation to this question.

MR. ACKERMAN:— We have sometimes placed the tile two feet below the base of the rail in the space between the two tracks, then filled over the tile with broken stone, so as to admit the water. I think there should be some provision to take the water away from the track, wherever the cities have objected seriously to putting the water into the sewer. As they always do object to its going into the sewer except through the catch basins, those drains are led to the catch basins and the water reaches the sewer through them in the same way as the storm water from the street.

MR. FRENCH:— We are compelled by the franchise under which we are relaying and reballasting a certain piece of double track, exposed Tee-rail construction, to place our rail on a level with the curb on the side of the street, making the ties practically 5 inches below the curb. The matter of drainage is going to be a very serious one, as we are on the side of a road that slopes up from the track. The only way that we can accomplish this is to put a line of sewer pipe between the tracks for the whole length of the strip and maintain our drainage ditches on the side to take the water; and every certain distance, about 200 or 300 feet, place small catch basins draining to the sewer. I believe an open trench is the best on private right-of-way. I don't believe tiled drainage is as good.

One matter which has interested me greatly is that of obtaining and keeping accurately the cost of doing work where we have to deal with foremen who can scarcely write their own names. To keep account of the different classes of work that a gang is doing and keep it accurately, is something that seems to me very nearly impossible. I would like to hear from some of the larger systems as to how they obtain their cost data for the different kinds of work they do during the year. In regard to the matter of material from jobs in the city streets, I find that there can be a great amount of money saved if the old material is put to good use, especially the old paving blocks and the old concrete. During the past year on one piece of work, when we rebuilt a single track line with double track 9-in. girder rail construction, I was surprised to find that we could rebuild almost the entire line with concrete and steel tie construction without using new stone by breaking up the old concrete and the paving blocks. Our experience with the concrete was that it cost from 40 to 45 cents per cubic yard to break it up. Breaking of paving blocks cost 60 cents per cubic yard. We found we could save more money by redressing the blocks for 55 cents per square yard, and, although the block is much lighter, it comes in for very good service for repaving our streets where there isn't very heavy traffic. I would like very much to hear about keeping cost data if there is anybody here who has a system by which they can keep it accurately.

VICE-PRESIDENT SIMMONS:—Can some of the representatives of the larger roads afford Mr. French the information he desires?

Mr. Griffin:— In the past I have had charge of the maintenance of an interurban branch of the system of the Rochester Railway, and would say that our method of getting cost has been by the use of a daily report from the different foremen, which report is subdivided into the different parts of which we wish to keep a record; such as work upon the track, the roadway, the ballast; and on our interurban railway lines upon ditching, fencing, road crossings, etc. The report also contained a space for whatever material was used in the different parts. In that way by checking up with the stock department and the timekeeper, it becomes a very easy matter to divide up the different maintenance items as fine as you wish to go.

Vice-President Simmons:— Is there any further discussion on this paper, gentlemen? We have a good deal to do, and if there is no further discussion —

Mr. Wilson:— I would like to make a little résumé of the points raised by the different speakers. With regard to preserving ties, our road has made some practical tests of the creosoting process of preserving ties. We find that this is very fine, but too expensive. The method will cost, in the Northwest at least, from 40 to 60 cents per tie. We believe that to be the only absolutely and thoroughly satisfactory method of treating the ties, and by that method the ties are rendered practically imperishable.

The question of contractors paying one rate and the railway company having a large crew of men at a different rate, is one with which the speaker has had some little experience. Our road has been paying $1.75 for ten hours and we have run into a number of cases where contractors were paying $2 and $2.15 and we were working right alongside of them; also cases where cities were paying $2 for but eight hours work. When you run up against a city crew that is getting $2 a day working eight hours, and your men are working ten hours for $1.75, you have got to keep busy if you want to keep your men. We sometimes furnish them transportation, which helps some. Our company pays every two weeks, which also helps. We also find that the cities do not begin their work quite as early in the season as we do. By getting ready before they do we can get our crew started early in the season. Finally, in the ultimate analysis, you have got to put your men on the same basis that the adjoining contractors and cities do. You have got to furnish them something in the nature of an equivalent, either steadier work or longer jobs, or something whereby you can hold the best men.

The question of welding old rails, is one with which the speaker has had some experience, as a good deal of the rail on our system has been welded. We have been able to secure a very much longer life for the rail and the paving has been kept in repair without any expense, and generally the results have been satisfactory. I was very glad to hear the applause on the question of the Tee rail. Our company believes in the Tee rail, and we also believe that if you will bring your delegates to the Twin Cities, we can do a little missionary work for you and can convince the people that you bring or send up there that the Tee rail can be laid and excellent pavement can be laid alongside of it which will be satisfactory to any person.

I heartily endorse Mr. Clark's remarks in regard to more machinery being needed in the track department.

So far as the drainage on city streets is concerned, the cities in which our company operates are perhaps rather more favorably situated in regard to the sewers being built on the combined plan, so that we are able to carry our drainage from the paved streets to the sewer; and in our paved streets we have no trouble with putting in track drips and carrying the water from them to the nearest manhole or catch basin. The question of drainage or subdrainage of a clay ground is something that is very difficult, and I presume that the only satisfactory method of providing a ground under drainage will be the use of tile in or under the ballast material.

In regard to the question of cost keeping, the system that is in use by the Twin City Company is that the timekeepers classify the work, and the time spent on the work by the various men. This timekeeping is done by men who do nothing else. The foremen are not expected to keep time at all, except for checking purposes. Whenever a piece of work is about to be commenced the timekeepers are given instructions as to what classes of work are to be kept separately. The auditing office divides the expenses, and keeps account of each different item of work separately. This system has seemed to give very satisfactory results in our experience.

Mr. Schreiber:—As to keeping costs of different work, I think it is only a question of the adoption of a proper system. We do not have any more trouble in ascertaining the cost of work when we have a great many jobs on hand and have over 3,000 men working in the summer than when our force is cut to 150 men in the winter. The general scheme is that all material is brought in and handled from one general distributing point, and the foreman on each particular job lays his work out in advance and sends in orders for material to the storekeeper, who checks charges that are made, each job being designated by a number. The material is then distributed according to the locations during the day or at night time by the regular supply trains. The keeping of time on our road is run on the same basis as explained by Mr. Wilson, that is, the timekeeper makes out the distribution, the time of every man being charged against a certain job number, and at the end of the month or week as is desired accounts are made up giving a list that is a summary of the storeroom orders and labor distribution showing the exact expenditure for labor and material against each piece of work.

President Adams:—Gentlemen, I understand from Mr. Simmons that Mr. Wilson was practically closing up the discussion on this paper, and, as the time is getting rather short, if there is no further discussion we had better proceed to the next paper which is the report of the Committee on Rail Corrugation Investigation. Mr. Simmons is chairman of the committee and will briefly present a report.

## REPORT ON "RAIL CORRUGATION" BY THE COMMITTEE ON MAINTENANCE OF WAY.

Your Committee on Maintenance of Way begs to submit the following report:

Among the subjects investigated by your Committee on Maintenance of Way this year was that of "Rail Corrugation." The following report on this subject embodies the questions contained in the data sheet and circular letter which were sent to the various member companies, and the answers which were received to these questions.

Out of forty-eight replies only thirteen contained any definite information on the subject of rail corrugation and even these answers seem to be considerably at variance with one another.

Answers to Question No. 1 indicate that various types of rails are subject to corrugation.

Answers to Question No. 2 indicate that about one-third of the companies have had different types of rails affected where conditions are similar, while the remaining two-thirds of those who answered the question have had but one type of rail affected in this way.

Answers to Question No. 3 indicate that the length of rail affected varies from three feet to several hundred feet.

Answers to Question No. 4 show that the length of time the rail is in service before corrugation appears, varies from four months to thirteen years.

Answers to Question No. 5 seem to bring out the fact that the length of corrugation is from one to fifteen inches.

Answers to Question No. 6 indicate that the depth of corrugation varies from an inappreciable amount up to 3/16 of an inch.

Answers to Question No. 7 show that deep girder rails are most liable to rail corrugation.

Question No. 8 is answered in a way that would indicate that the corrugations occur mostly upon track which is not laid upon a thoroughly rigid base.

Question No. 9 is answered by seven of the thirteen companies stating that the corrugations occur on the outer rail of slight curves. One company states distinctly that the corrugations are found on the inner rail of curves of large radius. Three companies state that the corrugations occur on straight track. Braking seems to have little effect, although three companies distinctly state that corrugations occur where brakes are most frequently applied.

Question No. 10 is answered by some companies stating that double-truck cars cause corrugations, and by others that corrugations occur where single-trucks are used. All answers to this question indicate heavy traffic on track affected.

Question No. 11 is answered in some detail by one company describing a machine which it has for grinding out the corrugations. This company has also remedied the defects in certain cases by stiffening the web of the rail either with fish plates, rail braces or other devices. It has been able to take out corrugations which were formed on the rail by the use of these stiffeners of the web. Two other companies have used a grinder for taking out the apexes of the corrugations, which, however, they did not consider satisfactory.

The companies which answer Question No. 12 seem to agree that the cause of the trouble is produced by rails being insufficiently supported, by the web of the rail being weak, that the track construction is faulty, and that the slipping of the wheel on the outer rail of curves produces the corrugation.

The Philadelphia Rapid Transit Company, which company appears to have had the greatest experience with this phenomenon, has given a very interesting account of its dealings with the subject, and this information is unusually instructive. The remedies applied and the expenditures made show that this company is treating the matter thoroughly and its progress will be watched with much interest during the next few years.

### QUESTIONS AND ANSWERS.

### Question 1.

*Type of rail affected?*

#### ANSWERS.

Mostly 95-lb. girder, about 9-in. in height.
—*Boston Elevated Railway Co., Boston, Mass.*

Nine inch girder.
—*Old Colony Street Railway Co.,*
—*Boston & Northern Street Railway Co., Boston, Mass.*

Grooved rail.
—*Springfield Street Railway Co., Boston, Mass.*

Nine inch semi-grooved.
—*Worcester Consolidated Street Railway Co., Worcester, Mass.*

Nine inch girder; Lorain Steel Co., sec. 94-313 and Johnson Co., 94-204.
—*International Railway Co., Buffalo, N. Y.*

Sec. 200 Penn. Steel Co.
—*United Railways & Electric Co., Baltimore, Md.*

All types; mostly 90-lb. girder.
—*Philadelphia Rapid Transit Co., Philadelphia, Pa.*

Lorain Steel Co., sec. 95-319; sec. 95-297; Pennsylvania Steel Co., sec. 95-222.
—*Cleveland Electric Railway Co., Cleveland, O.*

Seventy-pound A. S. C. E.
—*Indiana Union Traction Co., Anderson, Ind.*

Six-inch, 72-lb. Shanghai "Tee" rail.
—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*

Lorain Steel Co., sec. 94-313.
—*San Juan Light & Transit Co., San Juan, P. R.*

## Question 2.

*Are different types of rail affected where conditions are similar?*

### ANSWERS.

Yes. —*Boston Elevated Railway Co., Boston, Mass.*

Girder rails only seem to be affected.
—*Old Colony Street Railway Co.,*
—*Boston & Northern Street Railway Co., Boston, Mass.*

Not in our experience.
—*Springfield Street Railway Co., Boston, Mass.*

No, apparently not.
—*Worcester Consolidated Street Railway Co., Worcester, Mass.*

Yes.
—*International Railway Co., Buffalo, N. Y.*

Have only noticed this condition on the above mentioned section.
—*United Railways & Electric Co., Baltimore, Md.*

Yes.
—*Philadelphia Rapid Transit Co., Philadelphia, Pa.*

No.
—*Cleveland Electric Railway Co., Cleveland, O.*

Only one type affected.
—*Indiana Union Traction Co., Anderson, Ind.*

No.
—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*

No, 70-lb. A. S. C. E. "Tee" rail not affected.
—*San Juan Light & Transit Co., San Juan, P. R.*

## Question 3.

*Length of section affected?*

### ANSWERS.

Varies with the length of the curve.
—*Boston Elevated Railway Co., Boston, Mass.*

From 50 to 300 feet approximately.
—*Springfield Street Railway Co., Boston, Mass.*

About 150 feet in each case.
--*Worcester Consolidated Street Railway Co., Worcester, Mass.*

Three to 15 feet.
—*International Railway Co., Buffalo, N. Y.*

Usually entire length of rail. In a few instances several consecutive rails.
—*United Railways & Electric Co., Baltimore, Md.*

Short spots except on curves.
—*Cleveland Electric Railway Co., Cleveland, O.*

At various places over 25 miles of track.
—*Indiana Union Traction Co., Anderson, Ind.*

Three hundred to 400 feet in three locations.
—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*

Twenty to 40 feet.
—*San Juan Light & Transit Co., San Juan, P. R.*

## Question 4.

### *Length of time rail was in service before corrugation appeared?*

#### ANSWERS.

Varies from four months to five years according to the number of cars operated over it.
—*Boston Elevated Railway Co., Boston, Mass.*

From one and one-half to four years.
—*Springfield Street Railway Co., Boston, Mass.*

Cannot say; probably about three years.
—*Worcester Consolidated Street Railway Co., Worcester, Mass.*

Thirteen years and seven years.
—*International Railway Co., Buffalo, N. Y.*

Variable.

*— United Railways & Electric Co., Baltimore, Md.*

From three months to ten years.

*— Philadelphia Rapid Transit Co., Philadelphia, Pa.*

From three to four years.

*— Cleveland Electric Railway Co., Cleveland, O.*

Do not know.

*— Indiana Union Traction Co., Anderson, Ind.*

From three to four years.

*— The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*

Six years.

*— San Juan Light & Transit Co., San Juan, P. R.*

## Question 5.

*Length from center to center of corrugation?*

### ANSWERS.

Two to six inches, more or less.

*— Boston Elevated Railway Co., Boston, Mass.*

Two to twelve inches.

*— Old Colony Street Railway Co.,*
*— Boston & Northern Street Railway Co., Boston, Mass.*

Four to six inches.

*— Springfield Street Railway Co., Boston, Mass.*

Two to three inches.

*— Worcester Consolidated Street Railway Co., Worcester, Mass.*

Three to ten inches.

*— International Railway Co., Buffalo, N. Y.*

Three to eight inches.

*— United Railways & Electric Co., Baltimore, Md.*

Ten to fifteen inches.

*— Cleveland Electric Railway Co., Cleveland, O.*

One to about two inches.

*— Indiana Union Traction Co., Anderson, Ind.*

One-half to five or six inches.
*—The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*

Three to eight inches.
*—San Juan Light & Transit Co., San Juan, P. R.*

## Question 6.

*Depth of corrugation?*

### ANSWERS.

Nothing to possibly 3/16-in.
*—Boston Elevated Railway Co., Boston, Mass.*

From slight to about ⅛-in.
*—Old Colony Street Railway Co.,*
*—Boston & Northern Street Railway Co., Boston, Mass.*

One-sixty-fourth to 1/32-in.; very few 1/16-in.
*—Springfield Street Railway Co., Boston, Mass.*

One-eighth to 3/16-in.
*—Worcester Consolidated Street Railway Co., Worcester, Mass.*

One-sixty-fourth to 1/32-in.
*—International Railway Co., Buffalo, N. Y.*

One-thirty-second to ⅛-in.
*—United Railways & Electric Co., Baltimore, Md.*

One-sixteenth to 3/16-in.
*—Cleveland Electric Railway Co., Cleveland, O.*

About 0.01-in or less.
*—Indiana Union Traction Co., Anderson, Ind.*

Not appreciable yet.
*—The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*

Nothing to ⅛-in.
*—San Juan Light & Transit Co., San Juan, P. R.*

## Question 7.

***Please describe rails most affected, giving the type, weight, manufacturer, date rolled, date laid, and composition of rail, if possible.***

**ANSWERS.**

Ninety-five and 96-lb. half-grooved and tram-top girder rails, rolled by Pennsylvania Steel Co. and Lorain Steel Co., 1896 to date, because there were more of these than other types in the tracks.

*— Boston Elevated Railway Co., Boston, Mass.*

Pennsylvania Steel Co., secs. No. 200 and 201 seem to be the ones most affected. The weight of rails 90-lb. and 85-lb. respectively, and laid about ten years ago.

*— Old Colony Street Railway Co.,*
*— Boston & Northern Street Railway Co., Boston, Mass.*

Nine-inch Trilby, Metropolitan Section; 107-lb. Trilby and 95-lb. half-groove, Pennsylvania Steel Co. and Lorain Steel Co.

*— Springfield Street Railway Co., Boston, Mass.*

Pennsylvania Steel Co., semi-grooved girder rail, Section 222; composition, ordinary rolling; date rolled, 1901; weight, 95-lb. to yard.

*— Worcester Consolidated Street Railway Co., Worcester, Mass.*

Lorain Steel Co. sec. 94-313, semi-grooved, 1900 rolled, laid 1900; also Johnson Co., sec. 94-204, rolled 1894, carbon .45% to .55%; phosphorus not over .10%; silicon not over .20%; manganese .80% to 1.10%.

*— International Railway Co., Buffalo, N. Y.*

Pennsylvania Steel Co., sec. 200.

*— United Railways & Electric Co., Baltimore, Md.*

Do not have this information.

*— Cleveland Electric Railway Co., Cleveland, O.*

Seventy pound, A. S. C. E.; laid 1903; Lorian Steel Co., rolled 1902.

*— Indiana Union Traction Co., Anderson, Ind.*

Six-inch, 72-lb. "Tee" rail rolled in 1900 by the Cambria Co., carbon, .50% to .55%.

*— The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*

Sec. 94 — 313 rolled 1899.

*— San Juan Light & Transit Co., San Juan, P. R.*

## Question 8.

*Please describe the track construction, giving the rigidity, drainage, condition of paving and general method of construction, and specify as between track in paved streets and track laid on earth and loose stone or gravel ballast.*

### ANSWERS.

As a rule, on 6 by 8-in. ties with cast iron tie plates, 2-ft. 6-in. c.c. paved with granite blocks between rails and 18-in. outside, on gravel ballast. Also on tracks laid on concrete base, with all movement eliminated.

—*Boston Elevated Railway Co., Boston, Mass.*

Rail is laid on ties in gravel ballast. Track is paved between rails and outside with cobble and granite blocks.

—*Old Colony Street Railway Co.,*
—*Boston & Northern Street Railway Co., Boston, Mass.*

Seven-foot, 6 by 6-in. chestnut ties, 2-ft. centers and tie rods 7 feet apart and some of track laid with concrete base with granite block, brick, wood paving.

—*Springfield Street Railway Co., Boston, Mass.*

Track tie-rodded every 5 feet with standard 1-in. flat rods. Ties resting on gravel ballast; paving, granite block laid on cement foundation to bottom of ties with 2-in. sand, then the whole grouted with thin grout.

—*Worcester Consolidated Street Railway Co., Worcester, Mass.*

Solid concrete 6-in. under rail full width of track and 2 feet outside; drainage natural; No. 1 Medina block stone on 3-in. gravel cushion; stone grouted one part Portland cement and three parts sand; laid 1900. On the Johnson Co., sec. 94-204, track laid 1904, sand tamped, common stone paving, Medina sand stone.

—*International Railway Co., Buffalo, N. Y.*

Nine-inch girder rail laid in paved streets and spiked directly to tie, with gravel ballast.

—*United Railways & Electric Co., Baltimore, Md.*

We have had very little trouble except on curves. All track has concrete or broken stone bed.

—*Cleveland Electric Railway Co., Cleveland, O.*

Subgrade loam or clay, gravel ballast; interurban track; ties 2-ft. c.c., drainage fair.

—*Indiana Union Traction Co., Anderson, Ind.*

Concrete for 6 inches under ties. Asphalt pavement with granite toothing both sides of rails. City sewer underlaying in all three cases.

*—The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*

Lorain sec. 94-313; rail laid on 6 by 8-in.; 8-ft. ties; 2-ft. centers on gravel ballast, track paved with brick on 6-in. gravel base.

*—San Juan Light & Transit Co., San Juan, P. R.*

## Question 9.

*Please describe location of corrugations, both on straight tracks and as to inner or outer rails on curves, with degrees of curvature; as to grades and their percentage; as to points where brakes are applied and all other locations tending to indicate a cause. Are opposite rails always corrugated?*

### ANSWERS.

Corrugations occur usually on curves and adjacent tangents from 20 to 100 feet, and occur first on outer rails, both on the surface and side of treads, being later transferred to the inner rails to a greater or less degree.

*—Boston Elevated Railway Co., Boston, Mass.*

Corrugations appear generally on the long rail of curves which have no guard rails. They seldom appear on straight, and never on the short rail of curves, or on curves which have guard rails on either side.

*—Old Colony Street Railway Co.,*
*—Boston & Northern Street Railway Co., Boston, Mass.*

Almost invariably the outer on slight curves 1,200 to 2,000-ft. radius. Our observation is that at points where brakes are most used we find the most corrugation.

*—Springfield Street Railway Co., Boston, Mass.*

Corrugations (four or five in number) found only on inner rails on curves of 800 to 1,000-ft. radius. On nearly level track just where brakes are frequently applied.

*—Worcester Consolidated Street Railway Co., Worcester, Mass.*

Corrugations occur on tangent in spots all along the line, both where cars apply brakes and between blocks. On curves the worst corrugations come on outside rail; sometimes on inside curve of rail. Opposite rails are not always corrugated, although slightly affected.

*—International Railway Co., Buffalo, N. Y.*

On both straight and slightly curved tracks. In the latter case, however, only noticeable on outer rail. Grade does not seem to have much bearing on this matter. Opposite rails are not always corrugated.

—*United Railways & Electric Co., Baltimore, Md.*

The corrugations have appeared on the outside rails on long easy curves, where speed is high and no stops are made. Radius about 300 feet.

—*Cleveland Electric Railway Co., Cleveland, O.*

Corrugations not peculiar to either curves or tangents; noticed on 1° curve but on none of greater curvature; grades easy; not confined to either side of track on either curve or tangent.

—*Indiana Union Traction Co., Anderson, Ind.*

Straight track only; both rails; no reference to braking; believe it is in formation of rail, as rail affected is all from one rolling.

—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*

Corrugations occur on outer rail on 500 to 1,000-ft. radius curves on grades and on level track. Opposite rails not affected.

—*San Juan Light & Transit Co., San Juan, P. R.*

## Question 10.

*Please describe the traffic conditions at points of corrugation, giving frequency of car service, weight, types, and speed of cars, type of brake used, type of truck employed, etc.*

### ANSWERS.

Too complicated on this system.

—*Boston Elevated Railway Co., Boston, Mass.*

Corrugations are more pronounced and are longer on track where only single-truck cars are used.

—*Old Colony Street Railway Co.,*
—*Boston & Northern Street Railway Co., Boston, Mass.*

Double-truck car; three-minute car service; 20 to 22 tons. Straight side car; speed, eight miles per hour. Christensen air brake. Majority, Wason No. 16 truck.

—*Springfield Street Railway Co., Boston, Mass.*

About two-minute headway on average during daytime; weight of heaviest car, 25 tons. Both double and single-truck. Trucks: Taylor, Bemis, Laconia & Brill (single) and Curtis. Brakes, mostly air.

—*Worcester Consolidated Street Railway Co., Worcester, Mass.*

One-minute service; 18 to 30-ton cars; J. G. Brill type of car.
—*International Railway Co., Buffalo, N. Y.*

On one line in the morning the headway was three and four minutes. Five minutes throughout the day and three minutes during the evening, rush trips. The past year double-truck four-motor cars, weighing 45,000 pounds, light, with Brill, 27 G.E.1 trucks were used. Previous to that time, single-truck cars, averaging 20,000 pounds were used. Type of brake on both of these equipments was a sliding brake rigging. On another line the service was three minutes in the morning, four minutes throughout the day and two minutes during the evening, rush trips. For the past five years the cars used upon this line have been double-truck cars, in the winter weighing 29,000 pounds light, and in the summer, 12-bench and double-truck open cars, weighing 30,000 pounds, light. The trucks on both of these types of cars are Brill maximum traction, having a sliding brake rigging. The schedule speed upon both of these lines averages between eight and nine miles per hour and with a maximum for the four-motor equipment of 22 miles per hour. For the maximum traction two-motor equipment from 18 to 20 miles per hour.
—*United Railways & Electric Co., Baltimore, Md.*

Double-truck cars; city and suburban, 37,000 pounds; 50,000 pounds; one to five-minute service; 10 to 18 m.p.h.; air brakes, Baldwin & Brill.
—*Cleveland Electric Railway Co., Cleveland, O.*

An average of twenty cars each way per day.
—*Indiana Union Traction Co., Anderson, Ind.*

Heavy double-truck cars; about two-minute headway. Hand-wheel brake.
—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*

Cars of 13 tons capacity of 7.5-minute headway, passing at speed of eight miles per hour; maximum traction trucks. Hand brakes.
—*San Juan Light & Transit Co., San Juan, P. R.*

## Question 11.

***Please state what remedies have been applied, if any, and what result has been obtained therefrom; also the cost of applying such remedies, if possible.***

### ANSWERS.

We have temporarily helped matters by grinding off the top surface of corrugated rails, using a specially constructed motor-truck geared to advance slowly, the grinding wheel being guided so as to leave a plane surface on the top of the rail. As, however, this process does not take out the corrugations on the side of the head at the gage line, the hollows, after a while, occur again on the top surface of the rail, sooner than they would on a new rail.

—*Boston Elevated Railway Co., Boston, Mass.*

We have used a rail grinder in a few instances. Not very satisfactory because it is almost impossible to get a level surface the same as on a new rail.

—*Springfield Street Railway Co., Boston, Mass.*

None as yet. Cost of taking up paving prohibitive.

—*Worcester Consolidated Street Railway Co., Worcester, Mass.*

No remedies tried to date as corrugations are not deep enough to cause trouble.

—*International Railway Co., Buffalo, N. Y.*

No satisfactory remedy has been applied.

—*United Railways & Electric Co., Baltimore, Md.*

None; took rails out.

—*Cleveland Electric Railway Co., Cleveland, O.*

No remedies applied.

—*Indiana Union Traction Co., Anderson, Ind.*

Not developed sufficiently yet.

—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*

None.

—*San Juan Light & Transit Co., San Juan, P. R.*

## Question 12.

*Please give your general conclusions in the matter and such other information as you may think pertinent.*

### ANSWERS.

Many different theories have been advanced as to the cause of this trouble, and several remedies suggested, but the rails continue to become corrugated, even where the greatest care has been taken with the track construction to make it perfectly solid and free from vibration, and to properly widen the gage on the curve, etc. The conclusion seems to be that it is the direct result of the way that the trucks are designed at the present time and that there will be no effectual remedy until the wheels on each axle are made to always set radially. Of course, to bring about such radical changes in design involves many and, perhaps, insurmountable mechanical difficulties, so that rails will undoubtedly continue to corrugate for some time to come.

—*Boston Elevated Railway Co., Boston, Mass.*

We have the grooved rail in paved streets with concrete base, in the streets where we have gravel, and also in streets finished with macadam. We find that most of our corrugation is in the paved streets. It may be on account of having heavier traffic in the paved streets. We have not any "Tee" rail that is corrugated, and we have not any corrugated rail on tracks where we run only single-truck cars.

—*Springfield Street Railway Co., Boston, Mass.*

Think poorly adjusted brakes and their improper use, soft spots in rails, possible loosing of ties or too much rigidity of track, all might be responsible for corrugations.

—*Worcester Consodidated Street Railway Co., Worcester, Mass.*

We feel that a number of conditions produce corrugations:

1. Design of rail; web weak for weight of cars.
2. Side-bearing rail causing bad turning movement and causing side movement.
3. Material rolled too hot causing soft and hard spots in rail.
4. Poor workmanship on concrete under rail, allowing rail to work.

—*International Railway Co., Buffalo, N. Y.*

We have quite a lot of rail, Lorain Steel Co., sec. 86–329, bought and laid in 1898, which shows corrugation. None of this is so bad that it affects the riding of the car. We have not gone into the theory of the corrugation to any extent and are unable to throw any light on the subject. We have practically the same section which was put down in 1890 and 1891, and which is, in some sections, corrugated, but it is no worse than that put down in 1898, or as bad.

—*Capital Traction Co., Washington, D. C.*

We believe that the webs of rails are too light and that there has been a movement in the foundation. We know that when we had the most trouble the concrete was the poorest. On curves we believe that the corrugations are caused by the slipping of the wheels.

—*The Cleveland Electric Railway Co., Cleveland, O.*

Rail second quality from the best information I can obtain.

—*Indiana Union Traction Co., Anderson, Ind.*

The primary cause of corrugations in street car rails, it is assumed here, is vibration, either in the rails or in the entire track structure; that is, the wheels of motor or other power-driven cars have a tendency to skid or slip because of the rapid vibration of the rails, which, by reason of the inertia of the car, the wheels are unable to follow instantaneously, thereby causing friction between the wheels and rail to vary in accordance with the wave length of vibration.

The corrugations may arise from any one of four different causes: namely, the vibration or lateral bending of the web of the rail itself; the rails being loose on their supports; the ties being loose on their foundations; the vibration or movement of the foundation immediately under the track structure. Which one of these defects, or conditions, caused the corrugations can be ascertained by inspection of the head of the rail. Each condition produces corrugations of a different character, not only in length and form, but also with certain other peculiarities difficult of explanation without referring to a case in point.

The writer has several times been asked why these corrugations do not appear more frequently on steam roads, if they are, as he believes, due to vibration. The answer is, in his opinion, that the comparatively loose rail is forced ahead by the great weight of the locomotive in the well-known long wave, and that there is very little slipping in the wheels of the trailer cars. The writer has had several letters from engineers of foreign roads, describing their troubles with corrugated rails, and has noted that in the most serious cases the rails were supported by chairs or were provided with some form of a cushion. He thinks a careful inspection would show that there is a slight movement between the rail and its supports.

It has also been called to his attention that on some street car tracks where the rails were extremely loose there were apparently no corrugations. He has found, however, that in many cases the corrugations actually existed, but in such elongated form as not to be apparent from casual inspection. However, a rail flexible enough to produce only these long corrugations would bring other troubles quite as serious, and it would be practically impossible to maintain such a track in any heavily traveled paved street.

The writer has made quite a number of experiments and trials to verify his theory, and would call attention to one case. About five years ago it was proposed to reconstruct a section of double track about 2,000 feet in length, using a 90-lb. 9-in. girder rail laid on ties on a gravel base. When the excavation was made, however, the earth was found to be very spongy, consisting of clay and water-bearing gravel. For this reason the excavation was carried about 7 inches below the ties, and the space filled with concrete to a point one inch below the grade of the bottom of the ties. The ties were then carefully tamped with a mixture of fine concrete and the space between them filled to the base of the rail, which was also tamped. An additional two inches of concrete was then placed as a foundation for the paving.

After a year's service the rails of both tracks were found to be badly corrugated over practically their entire length, the corrugations being one inch to 1.5-in. apart and extending from the gage line over about two-thirds the width of the head. In order to ascertain the cause of this trouble, the paving and the concrete were removed above the ties, both in and outside the rails, and a careful inspection was made and measurements taken to ascertain if there were any vertical movement in the road-bed or rails, but none could be detected. It was thus evident that if the writer's theory was correct, there must be a lateral bending or vibration of the rail itself, and in order to ascertain if this were a fact an instrument was constructed. The frame may be rigidly clamped to the base of the rail, and a vertical arm is provided with a piston carrying a nut. The piston may be forced against the head of the rail by a spring behind the nut. The upper end of a hand, or pointer, engages the nut, the other end resting on a graduated arc. The lengths of the upper and lower arms of the hand or pointer are in the ratio of 10 to 1, each graduation representing 1/64 of an inch.

In using this machine it is only necessary to clamp it to the base of the rail and set the lower end of the hand at zero, which can be done by turning the piston in the nut. The amount of the lateral motion in the head of the rail, due to bending or buckling of the web, will then be indicated by a marker which is placed against the hand before a car is allowed to run over the rail. In many cases a movement of 3/32 of an inch has been noted.

In order to further verify the results of this experiment, fish plates 30 feet in length were secured and bolted to the outside of the rail, thus giving a support to the head and greatly stiffening the entire rail. After a few months it was found that on rails equipped with these fish plates corrugations were rapidly disappearing. As strengthening the rail in this manner would be too expensive to be practical, it was decided to stiffen the web of the rails by using a special brace on each alternate tie along the outside of the rails. This work was completed a little over a year ago, and a recent inspection shows that nearly all of the corrugations have disappeared.

It has been noted by some roads that corrugations were appearing on rails laid on a concrete base, but in every case that has come to the notice of the writer the rails had been temporarily supported by wooden ties, concrete being tamped under the base of the rail between the ties with no provision made for taking up the shrinkage, which always takes place during the settling and drying of the concrete.

In many cases where track is constructed in this manner the rails seldom have a continuous or uniform support, by reason of their not having anchorages or holding-down devices other than spikes in the ties, spaced at long intervals. This results in a slight movement of the rail on its foundation, and soon causes corrugations to appear, although quite frequently where light rail is used the trouble comes from the bending or buckling of the web of the rail, as noted above.

The writer believes that in concrete road-bed construction, it is absolutely necessary to provide some means of drawing the rail down on its bed, thereby taking up the shrinkage and preventing any liability of the rail moving on its foundation. In this class of construction, vibration can be prevented only by providing a rail of the proper design and an absolutely uniform and continuous support.

When the trouble in this construction is found to have been caused by loose rails or ties, the only remedy is to grind or file the head of the rails, and to immediately follow this work by firmly securing the rails to the ties and by tamping, using a coarse gravel wherever the foundation is found to consist of soft or spongy material.

Corrugations in light rails, due to the bending of the thin web, are difficult to remedy without considerable expense, but after the heads have been filed to a comparatively smooth surface, it has been found that setting the track to a slightly wide gage will sometimes prevent a recurrence of the defect.

It is very difficult to grind off the summits of corrugations without a specially constructed machine mounted on a truck and practically impossible with the usually portable grinding equipment, consisting of an emery wheel connected to a motor by a flexible shaft, because when the eye approaches the rail closely enough to permit the operator to manipulate the wheel the corrugations apparently disappear. In nearly all cases filing is probably the best method. The file should be mounted in a heavy cast-iron holder having guiding lugs bearing along the gage line of the rail and equipped with long handles at each end, so as to permit of operation by two men from a standing position. To prevent the possibility of trouble from bending of the webs of the rails, the writer, about two years ago, had the web of the heavy rail which his company is using increased to a thickness of 9/16-in. In support of the theory which he has advanced, he would add that on a system of about 600 miles he has been able to reduce the amount of corrugated rail to a very small percentage. The price of immunity from this trouble, however, is eternal vigilance, and it might also be added, the expenditure of considerable money in maintenance when any form of wooden support is used.

—*Philadelphia Rapid Transit Co., Philadelphia, Pa.*

Respectfully submitted,
FRED G. SIMMONS, *Chairman.*
THOS. K. BELL,
C. A. ALDERMAN,
*Committee on Maintenance of Way.*

Mr. Simmons presented the above report and at its conclusion said: I would suggest in connection with this investigation of rail corrugations — and a continuation of it — that there are many others besides our committee who are intererested in the matter. I know that Mr. Blake of the Street Railway Journal has been conducting an extensive inquiry into the matter in connection with some of the technical professors in the East as to the structure of the rail and the various elements entering into its composition, so I would suggest that probably this matter of rail corrugation investigation would rightly belong in the future to such committee as handles the question of rails in all details.

President Adams:—Gentlemen, this report is before you for discussion.

### *Discussion of Report on Rail Corrugation.*

Mr. Wilson:—Mr. President, our company has had a good deal of difficulty within the last two years, and apparently in an increasing ratio, with the corrugated rail. The trouble that we have had seems to develop with the more recently rolled rails, the rails which have been in service for the longest time not seeming to be the ones most seriously affected. I notice that the committee here includes reports from companies describing their troubles with corrugated rails, and in these cases the girder rail seems to be the most largely affected. The same trouble exists on the Tee rail unfortunately, so that it is not due to any one class of rail.

So far as the foundation is concerned, it seems to be a curious fact that while the trouble is ascribed to a defect in the foundation, yet almost all the cases of corrugated rail occur in paved streets. On earth streets, or on track which is open track, it very seldom if ever occurs, and this condition of things seems to be not only uniform among the different cities of the United States but the foreign writers on the same subject seem to find that the corrugation is confined almost entirely to streets with a very firm and solid stone ballast, or with a rigid foundation of some kind, so that it does not seem to be a question of the defective foundation altogether.

I think that this question of investigation of corrugation should be continued by the Committee on Rails, because it is certainly one of the worst troubles which exists today and is going to cause more inconvenience and expense in the future than we now have any idea of.

Mr. Voynow:—There is one cause for corrugations which I would like to advance as a theory, for it is capable of explaining the phenomenon of corrugations in all its varying manifestations. We have all noticed that on open tracks laid on a dirt foundation, such as some Tee rail tracks with joints open for expansion, where the rail can move in all directions, corrugations occur very seldom. I have seen corrugations under those conditions, but they were so very slight as to be almost imperceptible. But distinct corrugations do occur where the rail has a firm foundation. The firmer the foundation, and the heavier the rolling stock and traffic, and the faster the speed, the quicker corrugations will occur. This has brought out the idea that corrugations were caused by the elongation of the upper surface of the metal of the rail under the rolling action of the wheels. That such elongation does take place is an established fact. This can be seen in all old tracks which appear in the streets in vertical and horizontal curves; the length of the curves in both planes being the length of the rail. The horizontal curves have their rise at the middle of the rail, the joints being outward of the track thus forming a wide gage at these points. When an old track is taken up the loose rails are distinctly and permanently curved. How could these curves be explained otherwise than by the elongation of the surface fibres under the rolling action of the tread of the wheel and the friction of the flanges against the gage of the rail? The expansion of the exposed portion of the metal, due to the vibration in temperature, could have very little, if any, influence upon this,—for it works in both directions and therefore has a compensatory effect.

In order to understand this rolling action that causes the elongation, it can readily be assumed that the weight on the wheel and the pressure due to traffic produces an indentation in the surface of the rails directly under the wheels. This indentation is moved along causing the upper layer of the metal to flow in the direction of the traffic. When the movement of the wheels is slow it permits the metal to assume its original position on account of its elasticity. But when this movement is rapid, the stresses produced by this flow of the surface fibres results either in curving of the rail (elongation of the surface) when the rail is on a loose foundation; or in case of a solid foundation which permits of no such distortion it results in gradually pressing or rolling the surface metal until a maximum compression is reached, when the metal is formed into a hump over which the wheels roll and begin their action again, thus forming elevations and depressions at regular intervals — corrugations.

In assuming a cause in explanation of a phenomenon, such an assumption may only be dignified a theory, when, if not all, at least most of the known facts relative to such a phenomenon may be explained by this theory. And it appears to me that by careful analysis it will be found that by assuming the above theory as the principal cause for corrugations, all the varying, peculiar and seemingly contradictory manifestations of corrugations can be readily explained by it. By this could also easily be explained why in the loose Tee rail track, mentioned before, some corrugations may appear. While the rail could have given way under the stresses of the rolling, there might have been very heavy rolling stock, or high speed, or softness of metal in the rail, under either of which conditions, or in a combination of them, the stresses produced may have been so great that simple elongation was not sufficient to take it all up, and therefore the excess of the greater stresses resulted in partial corrugation. There may be secondary causes which occasionally produce of themselves characteristic deformations, such as sympathetic depressions on the other rail opposite original corrugations; opposite joints and frog openings; or those occasioned when cars start on slippery rail, or with brakes on (although the latter must come under the theory of elongation). But all these are distinct and recognizable.

From what I have said it must not be assumed that I advocate a dirt foundation for track construction. In order to explain under what conditions corrugations cannot occur it may be assumed, and this is quite evident, that cars run on two parallel lines of rails loosely placed on the surface of the earth, and without being held down in any way, will never cause any corrugations. But in a question of track construction there are so many important and paramount considerations which must govern the decision, that the trouble of corrugations is but secondary. Economy in the permanency of roadbed and paving, to avoid the ruinous expense on the maintenance of track, paving and rolling stock; the life of rail and joints, etc., is of so much vaster importance that the question of possible occurrence of corrugations (while the latter may be a contributing cause) can influence the decision but slightly; aside from the fact that in paved streets loose tracks of such construction as mentioned above and where corrugations cannot occur is out of the question, as it cannot be built. Therefore there can be but one conclusion and that is that a firm and permanent foundation, with the rail held on it as firmly as it is possible to attain in practice,— an ideal one, upon which rails may be renewed without the disturbance of the foundation, such as concrete, is the only practical and economical construction that can be advocated for paved streets, and especially so on busily traveled streets. Corrugations will or may occur but after one thorough filing, or possibly two, they will never become a cause of annoyance again; for the surface fibres of tread and gage will be compressed into such hardness that the wheel will not produce further indentations.

I know of a case where a new track was laid in concrete, without any chairs or ties, the concrete being thoroughly tamped, and corrugations occurred four months after it was laid, and became so heavy that it was thought that the track would have to be renewed. But after filing the rail thoroughly there has been no further occurrence of corrugation, and the track now is as good as new.

Mr. Reed:— Bearing out the theory of the last speaker, I would say that in my experience in New York City I never noticed any corrugations. The track is laid on cast iron yokes, five foot centers. The yokes are solid and rigid, but there is an opportunity for the track to give between the yokes, and it does so give, as a girder would give supported at the ends. I think that goes quite a distance in bearing out the remarks of the last speaker.

Mr. Simmons:— The experience we have had in Milwaukee with corrugated rails has been very slight, and while it would seem to bear out the remarks of Mr. Voynow, there was one peculiar thing about it, which gave rise to other questions in my mind — the corrugations appeared on tracks supported on ties at the regular spacing with our method of concrete construction, which consists of six inches of concrete below the tie and concrete between the tie and around rail, up to within about four inches of the surface. This track after having been in two years showed corrugations, very slight and very minor. The city had laid the abutting pavement against the track and the concrete on the top, which came up around the rail, and they had laid it in an inferior manner. In the course of the following year this pavement, and concrete, loosened up somewhat and as it loosened up the corrugations disappeared. The peculiar circumstance in connection with it was that this condition appeared at three different places on the system and at these three places the rails were all of one rolling. There was one certain rolling of rail which we received from one company which alone showed the corrugations. That brought to my mind the idea that possibly something in the composition of the rail, or the method of preparing it was at fault, to some extent. I therefore think that the corrugation question and the question of specifications for the rail may interweave, and that the Rail Committee would be the proper committee to carry on further investigation of the subject.

MR. OLDS:— I am not in the track department, but we, who have the care of the cars, are interested in having smooth track, and during Mr. Voynow's talk the thought came to me whether he had noticed if the corrugations were inclined to creep forward. Generally speaking, I understand it is on the tracks where the cars are always operated in one direction. I was wondering whether any one had marked a corrugation to see if there was a creeping or any advancement of the corrugation along the rail.

MR. VOYNOW:— The crests of the waves of corrugations at first glance seem peculiar, in that they vary in shape; nevertheless this seeming irregularity may be explained. The principal characteristics of these crests in the majority of cases are: first, they stand at an acute angle to the gage line with the opening towards the cars and the apex of the angle near the gage line; and second, that they are higher at this apex, which lies in the longitudinal line of maximum contact between wheel and rail. I have further noticed some of the crests become cone shaped, so that they can be seen as round, bright, elevated spots,—and upon closer observation it may be found that the base of these cones are elliptical, with the high spot situated at one of its centers and the long diameter standing at the same angle as mentioned before. Thus while the corrugations may vary in shape there is no reason to think that they creep along the rail.

All the above peculiarities can be explained; and they go to substantiate the proposed theory of the origin of corrugations. The angle of bevel of the rails is different from that of the wheels, and in the latter is, in the majority of cases, greater than in the rail. Naturally, under those conditions, when the wheel produces an indentation the first and greater stress originates at the point of greater contact between wheel and rail, which is near the gage line. As the wheel moves forward, this point of maximum stress will produce a correspondingly higher point in the resultant hump or crest. Also, at the beginning of the formation of the crest, when the bevel of the wheel at the back is not in complete contact with the back of the rail, that part of the crest nearer to the back of rail will lag behind, and therefore the resultant crest will assume the shape and angle mentioned:—higher near the gage and gradually diminishing and entirely disappearing at the back of the rail, as well as the highest point being forward and the whole crest standing diagonally across the rail head. The valleys, or lower points of the wave, are similarly distributed with their lowest points also near the gage line, which is quite natural, since more metal has been pushed out from there.

Again, at the point where the wave is formed under greater stress the fibres will be compressed into a great hardness and therefore remain more permanent (and possibly increase in height on account of the drop of the cars), while at the points near the back of the rail, they being softer, some corrugations may in course of time be worn away, thus forming the cone-shaped spots.

Mr. Matthews:— In Rochester we have only had one case of rail corrugation that gave us any trouble. It was on a double track on a three per cent. grade, corrugations appearing at the foot of the grade, on about 150 feet of track. Both up track and down track, seem to be affected equally, the rails being apparently rolled out as though they were soft. I had drillings taken out of the high spots and at the low spots of the rail and a chemical analysis made of these drillings. There did not seem to be any difference between the high and the low spots in percentage of carbon. The rails with the corrugations showed three-tenths (0.30) of one per cent. of carbon. I took a rail on an adjoining track, same kind of rail, 9-inch girder, which had given good service, and took a drilling from the web and tread, and chemical analysis of these drillings showed 51/100 of one per cent. of carbon, a much larger percentage of carbon than the corrugated rail, so that our conclusion was that the rail was low in carbon and therefore soft and the low places having started up by the spinning of a wheel or by braking, the truck passing over that low spot, would set up a vibration in such a way as to carry this corrugation on. The only thing we could do was to take the rails out and put in new ones.

Mr. Voynow:— I do not know whether the discussion covers the suggestion of methods for investigation of corrugations: but if it is in order I would venture to say that while some considerable and systematic investigations have been made, such as could be accomplished under conditions that already exist, nevertheless this is not sufficient. Strictly scientific methods only may bring satisfactory results. In order to do so, conditions must be created especially for such an investigation. Tracks must be built from various cross sections of rail, each from one particular run of rolling. The whole process of this rolling must be recorded. The tracks must be laid in short stretches under different methods of construction,— ties, concrete, chairs, etc. And this experimental track must be subjected to exactly identical traffic — as to speed, weight of rolling-stock, shape and manufacture of wheels, etc. Results obtained under these conditions only may be of sufficient accuracy to permit analysis.

**President Adams**:— Our time is getting rather close to the morning adjournment, but I do not want to close off this discussion which is one we could probably proceed with for the rest of the day. I want to say, however, that this is a report of the Way Committee on this particular subject, and that the consideration of the subject does not drop with this report. My understanding is that this matter is still in the hands of the Way Committee and will be carried forward by them for further investigation. Therefore, under the circumstances, I will call the discussion closed.

The next matter we have under consideration is the report of the Way Committee on Concrete Tie Investigation. This committee has made an investigation in this direction and has accumulated quite some data, but they have simply a report of progress to make.

**Mr. Simmons**:— There was not enough definite information secured to enable a report of any value to be presented. We found it would require more time for a larger number of experiments to be undertaken and the progress of the committee was not considered sufficiently ripe now to present any definite conclusions in the matter.

**President Adams**:— The next business will be the report of the Sub-committee on Rail and Rail Matters. I believe Mr. Simmons would like to say a word in connection with that, before Mr. Clark presents the report which has not been printed in advance.

**Mr. Simmons**:— What the Way Committee wishes to say in regard to the matter will come at the conclusion of Mr. Clark's abstract of the paper. There is a minority suggestion by one member of the committee, in connection with the report of the three members of the committee, and I understand that two of them would like to alter the form of the report as made at the present time. In that connection the Way Committee wishes to suggest further recommendations at the conclusion of the abstract of the report.

Mr. Clark then presented the report of the Sub-committee on Rail and Rail Matters.

## REPORT OF SUB-COMMITTEE ON RAILS AND RAIL MATTERS.

*To the American Street and Interurban Railway Engineering Association:*

GENTLEMEN:— Your sub-committee on Rails and Rail Matters, as a result of its study recommends as most economical for the railway companies and as a standard in cities where the use of the tee rail is approved, Lorain Steel Company, section No. 95–400 and Pennsylvania Steel Co., section No. 272, which are identical.

This rail is 7-in. high with a 6-in. base, head 3-in. wide, 1⅜-in. deep with web 17/32-in. thick and weighs 95 lbs. per yard.

In cities where the use of the Tee rail is not approved, your sub-committee recommends the proposed four half Trilby 9-in. and 7-in. sections illustrated in Fig. 1 and Fig. 2.

Their weights and principal dimensions are as follows:

*First.* 137 lb. per yard, 9-in. high, 6.5-in. base, 9/16-in. web, 3-in. head, 1 13/64-in. deep, with a top slope of 1.5 degrees, beveled outside edge 0.75-in. horizontal by 5/16-in. vertical, having a groove 1.25-in. deep by 1.75-in. wide with lip 0.75-in. wide, 0.5-in. below head and ⅞-in. maximum thickness; total top width of head and lip 5.5-in. Indicated by the full lines in Fig. 1.

*Second.* 122 lbs. per yard as indicated by the broken lines in Fig. 1, 9-in. high, 6-in. base, 0.5-in. web, 2.75-in. head, 1 3/32-in. deep with top slope of 1.5 degrees and beveled outside edge 0.5-in. wide, maximum thickness of lip about 0.75-in., with the other dimensions the same as first above noted.

*Third.* 122 lbs. per yard indicated by the full lines in Fig. 2, 7-in. rail, 6-in. base, 0.5-in. web, with the other dimensions the same as *first* above noted.

*Fourth.* 98 lbs. per yard, 7-in. rail, 5.5-in. base, 7/16-in. web, as indicated in Fig. 2 by broken lines, with the other dimensions as given in *second* above.

Sections of proposed tram rails of 9-in. and 7-in. height with beveled heads to correspond with the half Trilby sections above noted, have been designed and are shown in Fig. 3 and Fig 4.

By the full lines in Fig. 3, a 9-in. tram rail to weigh 137 lb. per yard, is shown.

By the broken lines in Fig. 3, a 9-in. tram rail to weigh 120.3 lb. per yard, is shown.

By the full lines in Fig. 4, a 7-in. tram rail to weigh 122 lb. per yard, is shown.

By the broken lines in Fig. 4, a 7-in. tram rail to weigh 96.4 lb. per yard, is shown.

Sections of grooved guard rails for special work have also been designed, 9-in. and 7-in. high, with beveled heads. These are shown in Fig. 5, Fig. 6, Fig. 7 and Fig. 8, having grooves 1½-in. and 1⅜-in. wide, of heavy and light weight as follows:

By the full lines in Fig. 5, a 9-in. rail, groove 1.5-in. wide, to weigh 156.2 lb. per yard.

By the broken lines in Fig. 5, a 9-in. rail, groove 1.5-in. wide, to weigh 139.7 lb. per yard.

By the full lines in Fig. 6, a 7-in. rail, groove 1.5-in. wide, to weigh 141.2 lb. per yard.

By the broken lines in Fig. 6, a 7-in. rail, groove 1.5-in. wide, to weigh 115.8 lb. per yard.

By the full lines in Fig. 7, a 9-in. rail, groove 1⅜-in. wide, to weigh 155 lb. per yard.

By the broken lines in Fig. 7, a 9-in. rail, groove 1⅜-in. wide, to weigh 138.6 lb. per yard.

By the full lines in Fig. 8, a 7-in. rail, groove 1⅜-in. wide, to weigh 140 lb. per yard.

By the broken lines in Fig. 8, a 7-in. rail, groove 1⅜-in. wide, to weigh 114.7 lb. per yard.

The lip in each pattern of guard rail is shown ⅜-in. above the head.

Four patterns of splice bars would be required for the sixteen rail sections proposed, which might be 6 or 12 hole to meet the views of the user, although best practice would doubtless altogether avoid the use of bolted splices in paved streets.

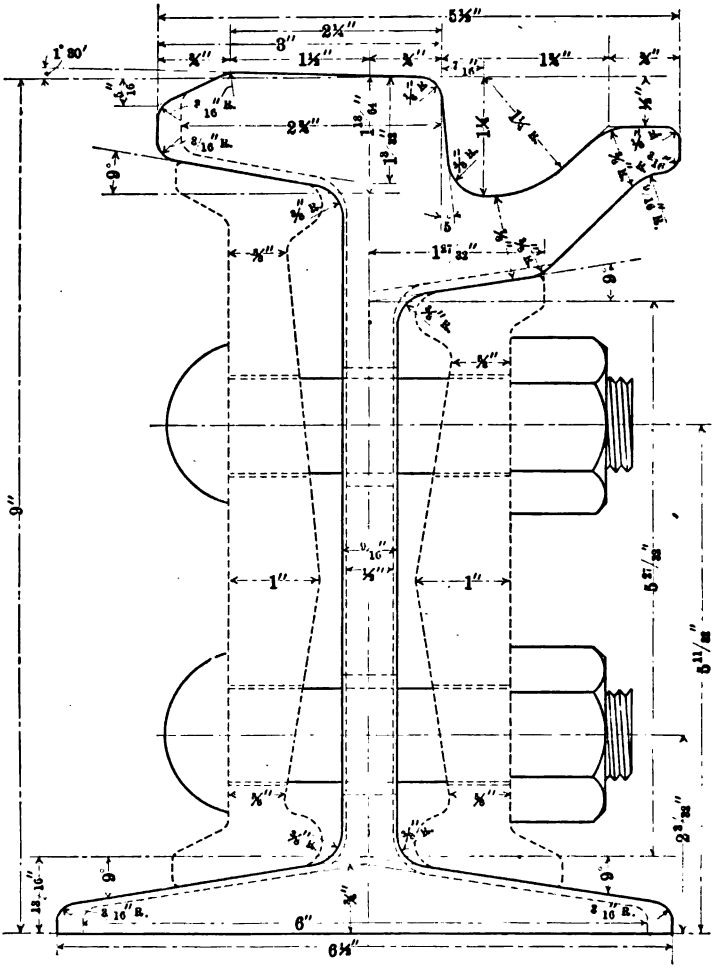
No recommendation concerning splices is now made by your sub-committee.

In Fig. 9, Fig. 10, Fig. 11 and Fig. 12 are shown the relation to the proposed heads of wheels with flanges of 1-in., ⅞-in. and ¾-in. depth and heads of 3½-in. 3-in. and 2½-in. widths.

Fig. 13 shows by broken lines the planing of special work suggested on outside and inside guard rails on curves for the minimum waste of metal combined with the maximum guard rail effect.

Respectfully submitted,

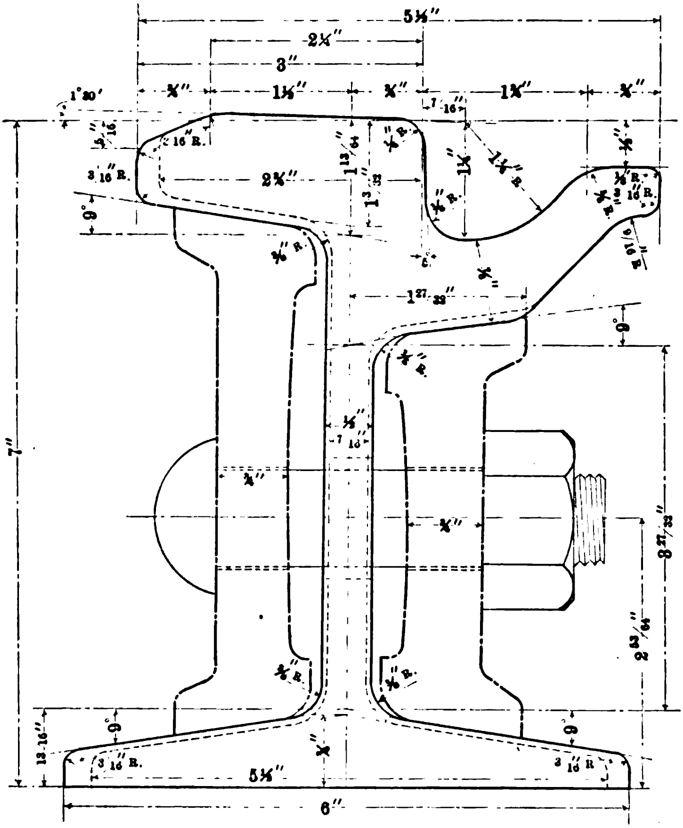
JULIAN GRIGGS, *Chairman,*
Chief Engineer Scioto Valley Traction Co., Columbus, Ohio.
CHAS. H. CLARK,
Engineer M. W. International Railway Co., Buffalo, N. Y.
E. O. ACKERMAN,
Engineer M. W. Columbus Railway & Light Co., Columbus, Ohio.
*Sub committee on Rails and Rail Matters.*



|  | Per Cent. | Area in. Sq.In | Weight lbs. per yd. |
|---|---|---|---|
| Head | 48.2 | 6.48 | 66.1 |
| Web | 24.9 | 3.35 | 34.2 |
| Flange | 26.9 | 3.60 | 36.7 |
| Total | 100.0 | 13.13 | 137.0 |

|  | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| Head | 49.5 | 5.92 | 60.4 |
| Web | 25.7 | 3.08 | 31.4 |
| Flange | 24.8 | 2.96 | 30.2 |
| Total | 100.0 | 11.96 | 122.0 |

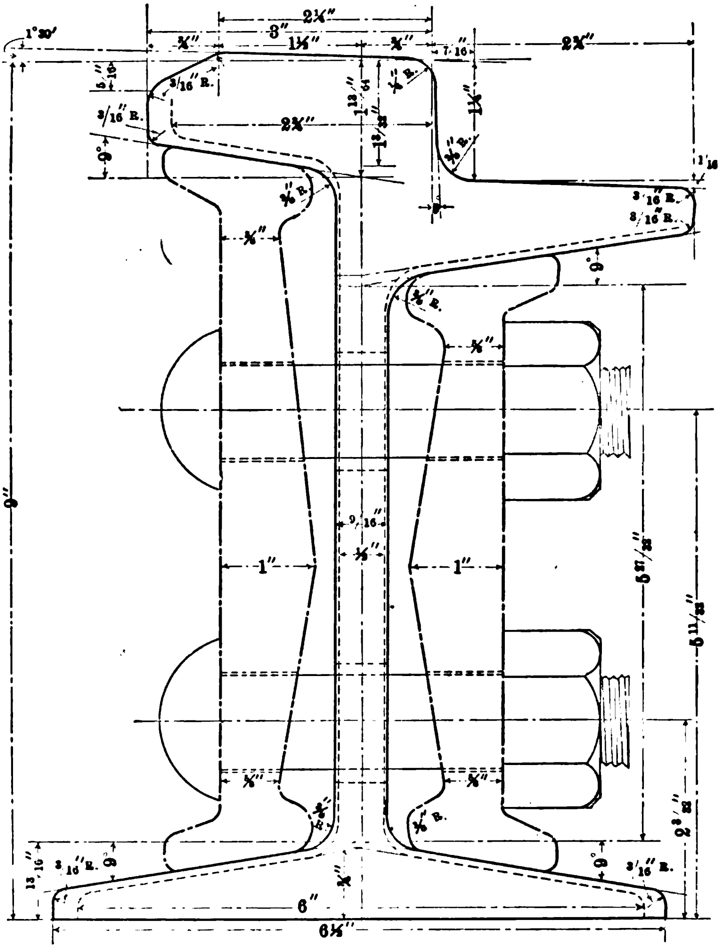
FIG. I.—137.0-LB. AND 122.0-LB. 9-IN. HALF TRILBY RAILS.



| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| Head | 54.1 | 6.48 | 66.1 |
| Web | 16.9 | 2.02 | 20.6 |
| Flange | 28.9 | 3.46 | 35.3 |
| Total | 100.0 | 11.96 | 122.0 |

| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| Head | 61.6 | 5.92 | 60.3 |
| Web | 18.8 | 1.81 | 18.5 |
| Flange | 19.6 | 1.88 | 19.2 |
| Total | 100.0 | 9.61 | 98.0 |

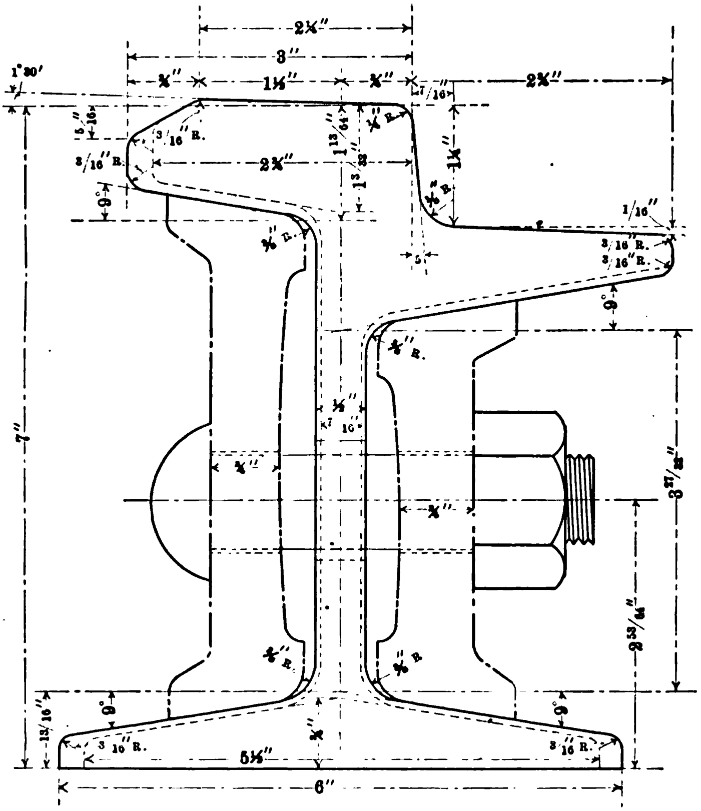
FIG. 2.— 122.0-LB. AND 98.0-LB. 7-IN. HALF TRILBY RAILS.



|  | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| Head | 48.2 | 6.48 | 66.1 |
| Web | 24.9 | 3.35 | 34.2 |
| Flange | 26.9 | 3.60 | 36.7 |
| Total | 100.0 | 13.43 | 137.0 |

|  | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| Head | 48.8 | 5.76 | 58.7 |
| Web | 26.1 | 3.08 | 31.4 |
| Flange | 25.1 | 2.96 | 30.2 |
| Total | 100.0 | 11.80 | 120.3 |

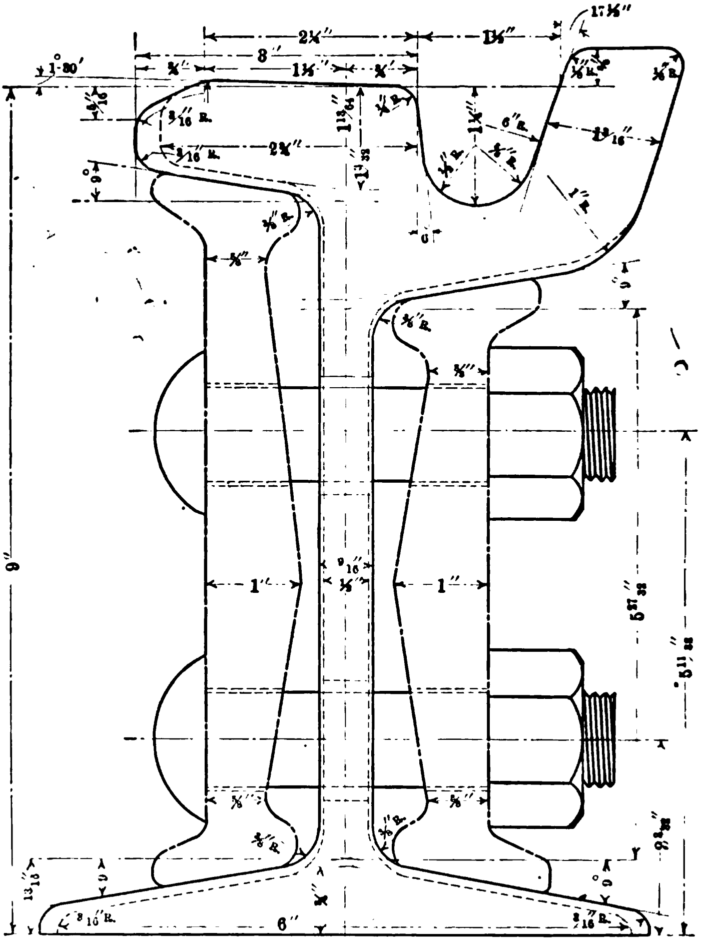
FIG. 3.— 137.0-LB. AND 120.3-LB. 9-IN. TRAM RAILS.



| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| **Head** | 54.2 | 6.48 | 66.1 |
| **Web** | 16.9 | 2.02 | 20.6 |
| **Flange** | 28.9 | 3.46 | 35.3 |
| **Total** | 100.0 | 11.96 | 122.0 |

| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| **Head** | 61.0 | 5.76 | 58.7 |
| **Web** | 19.1 | 1.81 | 18.5 |
| **Flange** | 19.9 | 1.88 | 19.2 |
| **Total** | 100.0 | 9.45 | 96.4 |

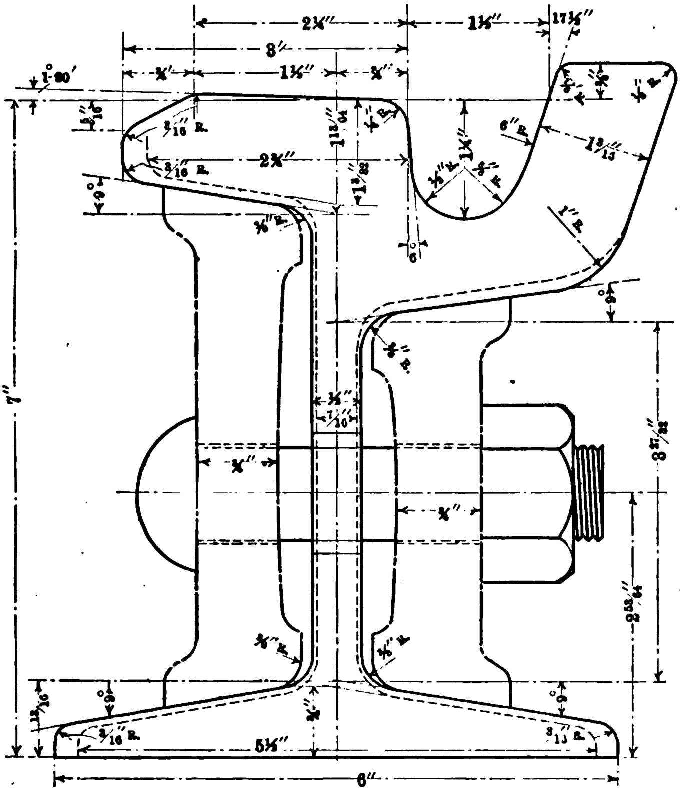
FIG. 4.— 122.0-LB. AND 96.4-LB. 7-IN. TRAM RAILS.



| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| Head | 54.6 | 8.36 | 85.3 |
| Web | 21.9 | 3.35 | 34.2 |
| Flange | 23.5 | 3.60 | 36.7 |
| Total | 100.0 | 15.31 | 156.2 |

| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| Head | 55.9 | 7.66 | 78.1 |
| Web | 22.5 | 3.08 | 31.4 |
| Flange | 21.6 | 2.96 | 30.2 |
| Total | 100.0 | 13.70 | 139.7 |

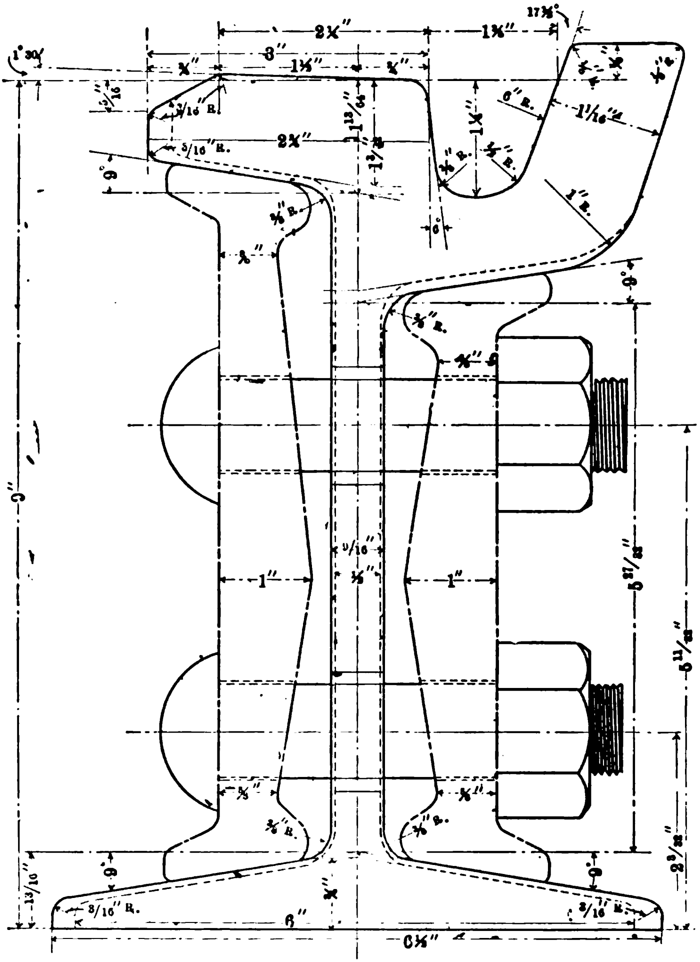
FIG. 5.—156.2-LB. AND 139.7-LB. 9-IN. GROOVED GUARD RAILS.



| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| **Head** | 60.4 | 8.36 | 85.3 |
| **Web** | 14.6 | 2.02 | 20.6 |
| **Flange** | 25.0 | 3.46 | 35.3 |
| **Total** | 100.0 | 13.84 | 141.2 |

| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| **Head** | 67.5 | 7.66 | 78.1 |
| **Web** | 15.9 | 1.81 | 18.5 |
| **Flange** | 16.6 | 1.88 | 19.2 |
| **Total** | 100.0 | 11.35 | 115.8 |

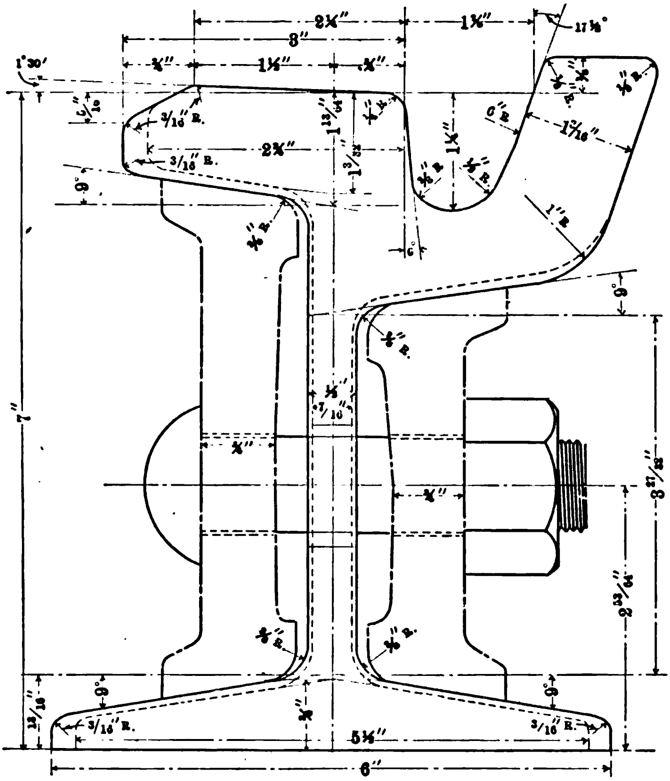
FIG. 6.— 141.2-LB. AND 115.8-LB. 7-IN. GROOVED GUARD RAILS.



| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| Head | 54.3 | 8.25 | 84.1 |
| Web | 22.0 | 3.35 | 34.2 |
| Flange | 23.7 | 3.60 | 36.7 |
| Total | 100.0 | 15.20 | 155.0 |

| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| Head | 55.6 | 7.55 | 77.0 |
| Web | 22.7 | 3.08 | 31.4 |
| Flange | 21.7 | 2.96 | 30.2 |
| Total | 100.0 | 13.59 | 138.6 |

FIG. 7.— 155.0-LB. AND 138.6-LB. 9-IN. GROOVED GUARD RAILS



| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| **Head** | 60.1 | 8.25 | 84.1 |
| **Web** | 14.7 | 2.02 | 20.6 |
| **Flange** | 25.2 | 3.46 | 35.3 |
| **Total** | 100.0 | 13.73 | 140.0 |

| | Per Cent. | Area in Sq.In. | Weight lbs. per yd. |
|---|---|---|---|
| **Head** | 67.2 | 7.55 | 77.0 |
| **Web** | 16.1 | 1.81 | 18.5 |
| **Flange** | 16.7 | 1.88 | 19.2 |
| **Total** | 100.0 | 11.24 | 114.7 |

FIG. 8.—140.0-LB. AND 114.7-LB. 7-IN. GROOVED GUARD RAILS.

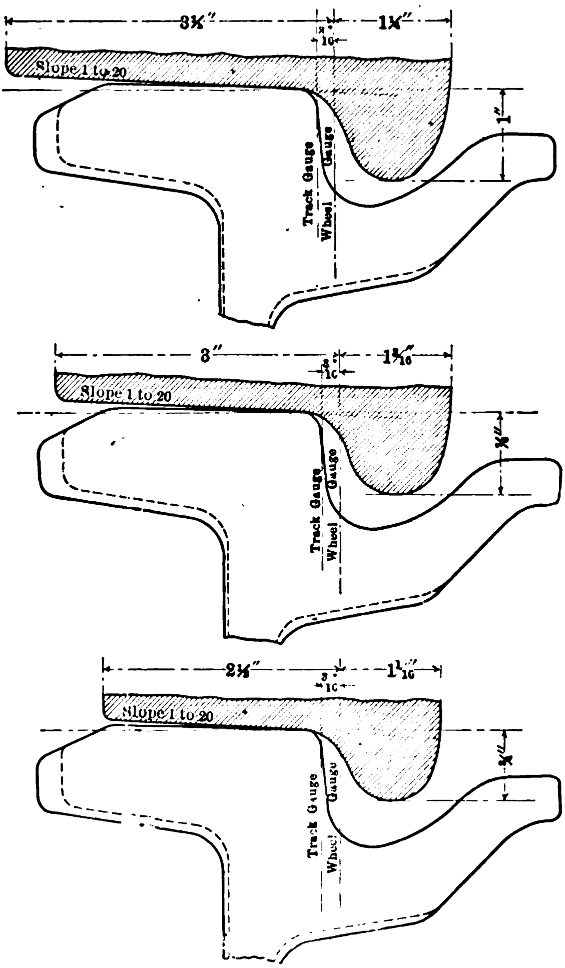


FIG. 9.— RELATION OF WHEEL FLANGES TO THE RAIL HEADS OF THE PROPOSED HALF TRILBY SECTIONS.

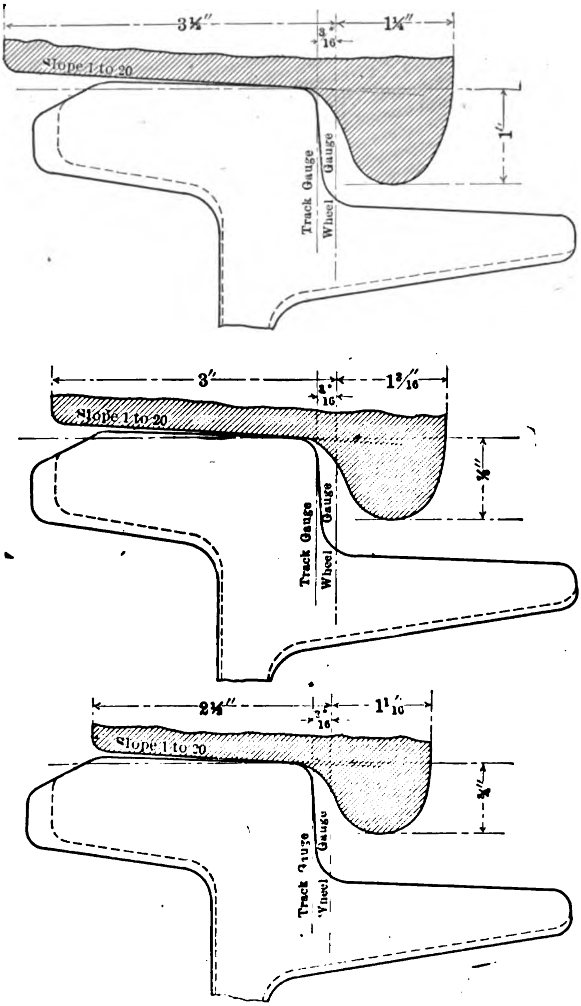


FIG. 10.— RELATION OF THE WHEEL FLANGES TO THE RAIL HEADS OF THE PROPOSED TRAM SECTIONS.

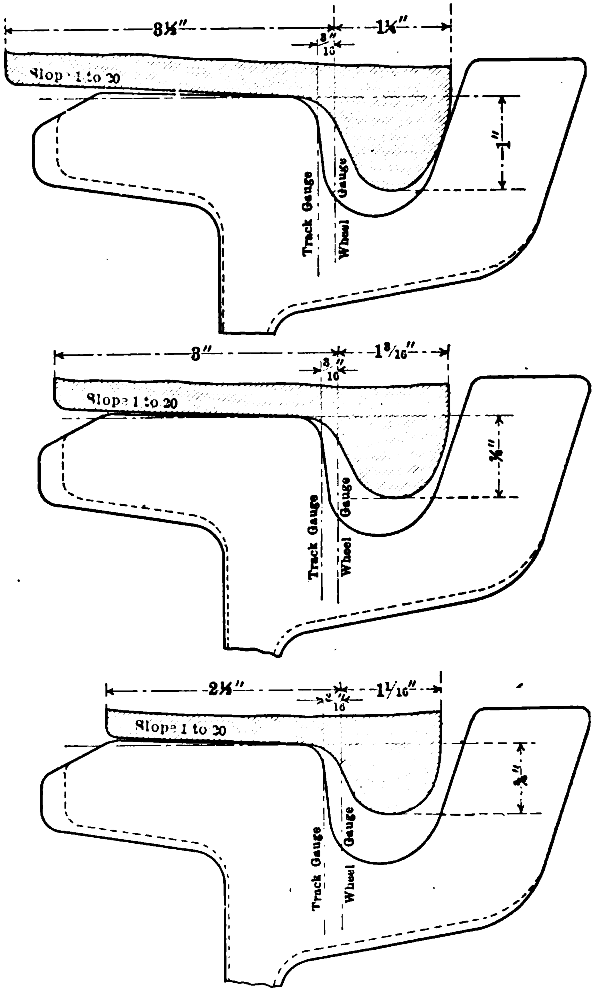


FIG. 11.—RELATION OF WHEEL FLANGES TO THE RAIL HEADS OF THE PROPOSED GROOVED GUARD SECTIONS WITH GROOVE 1.5-IN. WIDE.

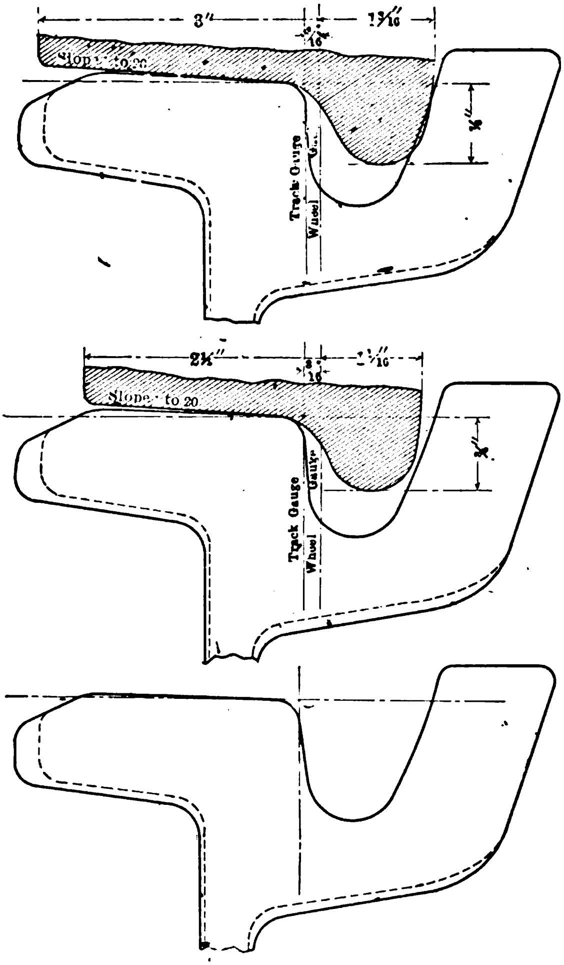


Fig. 12.—Relation of Wheel Flanges to the Rail Heads of the Proposed Grooved Guard Rail Sections with Groove 1.375-in. Wide.

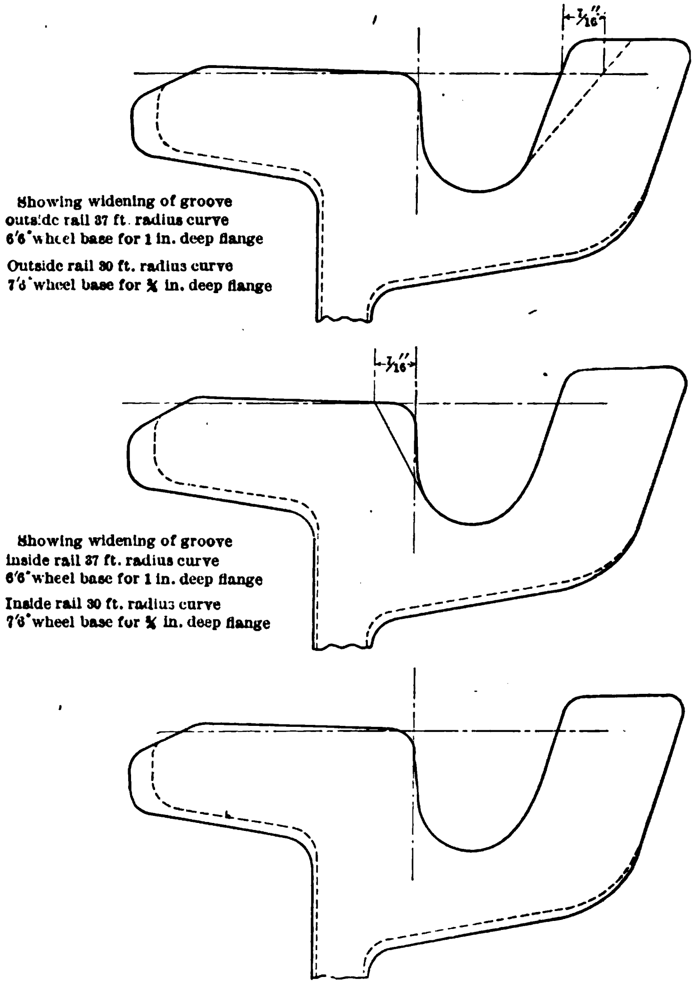

1/16"
Showing widening of groove
outside rail 37 ft. radius curve
6'6" wheel base for 1 in. deep flange
Outside rail 30 ft. radius curve
7'6" wheel base for 3/4 in. deep flange
1/16"
Showing widening of groove
inside rail 37 ft. radius curve
6'6" wheel base for 1 in. deep flange
Inside rail 30 ft. radius curve
7'6" wheel base for 3/4 in. deep flange

FIG. 13.— SUGGESTED PLANING OF SPECIAL WORK ON CURVES.

## APPENDIX.

Three forms of circular letters were sent to street and interurban railway officials and as a matter of record the replies received are classified and summarized below:

### CIRCULAR NO. 12, OF SEPTEMBER, 1906.

Your sub-committee had the replies to Circular No. 12, of September, 1906, sent out by Mr. Swenson, the secretary of the American association, which gave a large amount of information as to the number and weight of single and double-truck cars in service, weight and patterns of rail, gage of track and miles operated, plans of track construction, suggested standard and a list of cities prohibiting "Tee" rails.

There are listed nearly 1,500 street and interurban railway companies in America and presumably the major portion received this circular. Eighty-one replies were made, which were classified as urban, interurban and both urban and interurban. A total of about 10,000 miles out of a possible 38,000 miles in the whole country. Replies were seldom given to all of the questions propounded, but the variety of rail sections in use were apparent, being practically all that have ever appeared in any American Rail Maker's Catalogue, with a sprinkling of European sections.

| *Classification.* | *No. replies* | *No. cars in service.* | *Miles of track* |
|---|---|---|---|
| Urban | 36 | 13,184 | 3,775 |
| Urban and Interurban | 42 | 8,958 | 5,628 |
| Interurban | 3 | 68 | 134 |
| Total | 81 | 22,210 | 9,537 |

A better idea of the current requirements for rail in street railway service was obtained from the tabulation by percentages of high "Tee," grooved and other girder rails shipped in 1903, 4, 5 and 6, by the Pennsylvania Steel Company and the Lorain Steel Company, kindly furnished your sub-committee by these companies, which are the only makers in America of the classes of rail named. The statement is as follows:

SUMMARY OF TYPE OF RAILS ROLLED BY THE PENNSYLVANIA STEEL COMPANY AND THE LORAIN STEEL COMPANY IN THE YEARS 1903, 1904, 1905 and 1906 OTHER THAN STANDARD "TEES."

| *Class of Rail.* | *Penn. Steel Co. Per cent.* | *Lorain Steel Co. Per cent.* |
|---|---|---|
| High "Tee" | 22.376 | 23.18 |
| Full Groove | .943 | .84 |
| Half Groove | 8.466 | 22.92 |

| *Class of Rail.* | *Penn. Steel Co. Per Cent.* | *Lorain Steel Co. Per cent.* |
|---|---|---|
| Trilby | 21.237 | 25.18 |
| Plain Tram | 31.570 | 17.43 |
| Guard | 9.107 | 10.45 |
| Girder for Steam Roads | 6.296 | ..... |
|  | 100.00 | 100.00 |

SUMMARY OF TYPE OF RAILS ROLLED BY THE PENNSYLVANIA STEEL COMPANY FOR EACH OF THE YEARS 1903, 1904, 1905 and 1906, OTHER THAN STANDARD TEES.

| *Class of Rail.* | *Per cent. for 1903* | *Per cent. for 1904* | *Per cent. for 1905* | *Per cent. for 1906* | *Per cent. of total.* |
|---|---|---|---|---|---|
| High Tee | 12.21 | 18.48 | 26.27 | 30.38 | 22.376 |
| Full Groove | 3.86 | ........ | ........ | ........ | .943 |
| Half Groove | 17.77 | 5.79 | 3.73 | 4.88 | 8.466 |
| Trilby | 18.11 | 18.22 | 26.99 | 21.51 | 21.237 |
| Plain Tram | 26.99 | 45.46 | 28.77 | 31.20 | 31.570 |
| Guard | 8.98 | 5.30 | 9.93 | 10.37 | 9.107 |
| Girder for steam roads. | 12.78 | 6.72 | 4.29 | 1.98 | 6.296 |
| Total per cent | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

SUMMARY OF TYPE OF RAILS ROLLED BY THE LORAIN STEEL COMPANY FOR EACH OF THE YEARS 1903, 1904, 1905 AND 1906, OTHER THAN STANDARD TEES.

| *Class of Rail.* | *Per cent. for 1903* | *Per cent. for 1904* | *Per cent. for 1905* | *Per cent. for 1906* | *Per cent. of total.* |
|---|---|---|---|---|---|
| High Tee | 28.17 | 15.18 | 18.18 | 28.14 | 23.18 |
| Full Groove | 2.01 | 1.59 | .55 | .08 | .84 |
| Half Groove | 13.53 | 36.44 | 23.87 | 20.24 | 22.92 |
| Trilby | 14.09 | 20.54 | 30.74 | 29.22 | 25.18 |
| Plain Tram | 30.72 | 15.70 | 16.96 | 11.91 | 17.43 |
| Guard | 11.48 | 10.55 | 9.70 | 10.41 | 10.45 |
| Total per cent | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

SUMMARY OF RAIL SECTIONS OTHER THAN STANDARD TEE ROLLED BY THE PENNSYLVANIA STEEL COMPANY IN 1903, 1904, 1905 and 1906.

| *Class of Rail* | *Per cent of total.* | *Height. Inches.* | *Weight per yd.* | *Section number.* |
|---|---|---|---|---|
| High Tee | .000 | 5 | 56 | 253 |
| High Tee | 2.242 | 6 | 60 | 209 |
| High Tee | 4.519 | 6 | 62 | 242 |
| High Tee | 3.343 | 6 | 73 | 274 |

| *Class of Rail.* | *Per cent. of total.* | *Height. Inches.* | *Weight per yd.* | *Section number.* |
|---|---|---|---|---|
| High Tee | 6.782 | 7 | 70 | 206 |
| High Tee | .946 | 7 | 80 | 277 |
| High Tee | 3.932 | 7 | 95 | 272 |
| High Tee | .615 | 8 | 79 | 271 |
| Girder Plain Tram | 1.406 | 6 | 70 | 85 |
| Girder Plain Tram | .000 | 6 | 75 | 85–A |
| Girder Plain Tram | .613 | 7 | 73 | 275 |
| Girder Plain Tram | .000 | 7 | 73 | 91 |
| Girder Plain Tram | 11.298 | 7 | 80 | 238 |
| Girder Plain Tram | 1.126 | 7 | 85 | 257 |
| Girder Plain Tram | 4.548 | 8 25/32 | 95 | 223 |
| Girder Plain Tram | 2.724 | 9 | 85 | 201 |
| Girder Plain Tram | 7.056 | 9 | 90 | 200 |
| Girder Plain Tram | 2.798 | 9 | 94 | 224 |
| Girder Half Groove | .239 | 7 | 72 | 94 |
| Girder Half Groove | .402 | 7 | 85 | 256 |
| Girder Half Groove | .000 | 7 | 90 | 255 |
| Girder Half Groove | 6.998 | 8 25/32 | 95 | 222 |
| Girder Half Groove | .096 | 9 | 85 | 219 |
| Girder Half Groove | .734 | 9 | 87 | 240 |
| Girder Half Groove | .864 | 7 | 83 | 211 |
| Girder Half Groove | .000 | 8 | 90 | 259 |
| Girder Half Groove | .079 | 8 | 95 | 258 |
| Girder Half Groove | .009 | 8 25/32 | 94 | 226 |
| Girder Trilby | 2.584 | 7 | 90 | 243 |
| Girder Trilby | 2.990 | 7 | 107 | 254 |
| Girder Trilby | .889 | 7 | 110 | 276 |
| Girder Trilby | 1.536 | 9 | 98 | 241 |
| Girder Trilby | .000 | 9 | 104 | 260 |
| Girder Trilby | 8.120 | 9 | 107 | 228 |
| Girder Trilby | 1.456 | 9 | 113 | 276 |
| Girder Trilby | .734 | 9 | 115 | 279 |
| Girder Trilby | 2.929 | 9 | 125 | 273 |
| Steam Railroad Work Girder | 1.434 | 7 | 86 | 217 |
| Steam Railroad Work Girder | 4.862 | 9 | 141 | 263 |
| Girder Guard Rails | 1.121 | 6 | 82 | 86 |
| Girder Guard Rails | .400 | 7 | 92 | 212 |
| Girder Guard Rails | 1.716 | 7 | 92 | 215 |
| Girder Guard Rails | 1.904 | 7 | 110 | 234 |
| Girder Guard Rails | .263 | 9 | 100 | 230 |
| Girder Guard Rails | 1.152 | 9 | 103 | 208 |
| Girder Guard Rails | 3.087 | 9 | 128 | 250 |
|  | 100 |  |  |  |

These summaries show that about 23 per cent. of all shipments were High Tees; 25 per cent. Plain Trams and 52 per cent. Groove and Half Grooved rails of various patterns.

29 companies reported Tee rails prohibited in municipalities.
36 companies reported Tee rails permitted in municipalities.
16 companies neglected to answer this question.
—
81 total companies reporting.

Geographically the Tee rail is generally prohibited in large cities of the East, Texas, and the middle west except Indianapolis.

Tee rail is permitted in cities of the South and West and the smaller cities of New England where macadam streets are commonly in vogue.

In answer to the request for suggestions for a standard rail, 32 companies reply and for the most part suggest Tee rails. Nine companies only suggest Grooved or Tram rails.

Twenty-one companies show plans of track construction ranging from girder rails with steel ties and concrete beams to shallow Tee rails on wooden ties with gravel ballast.

### CIRCULAR WITH BLUE PRINTS OF RAIL STANDARD PROPOSED BY SUB-COMMITTEE ON RAILS AND RAIL MATTERS.

Under date of August 13, 1907, your sub-committee sent a circular letter with 13 blue print sheets illustrating its sections of proposed rail standards as shown in this report to 81 companies having 100 miles or more of track in cities of 100,000 population and upward and to 40 city engineers of such cities, requesting criticism of the proposed standards or any suggestions.

Fifteen companies replied.

4 of which used only Tee rails.
5 say standards proposed are satisfactory or show them in line with their practice.
1 company objects to less than 6.5-in. base for the lighter sections.
1 company is using narrow tread wheels, which leave a ridge on the outside of wide rail heads.
1 company thinks 9/16-in. web a minimum thickness for rails 7-in high and over to prevent rail corrugation.
1 company uses rails nearly like illustration of tram rail as shown in Fig. 3.
2 companies acknowledge circular but make no comments.
—
15 total companies replying.

Out of 40 city engineers, 12 reply.

2 object to bevel heads and think lip on all rails including guard rails should be the same height as the head.

1, Philadelphia, where the beveled head is most extensively used (L. S. Co., § 141–395, and P. S. C. 141–263 for steam roads, are standard) the city engineer reports it satisfactory and a great improvement over the old-fashioned tram. The gage of track is 5 'ft. 2.25-in., the same as for vehicles which are reported as having no difficulty in turning in and out of track or in crossing the same.

3 prefer Trilby.

5 make no comment.

1 is satisfied with standards proposed.

—

12 replies from city engineers.

### CIRCULAR ON SPECIFICATIONS FOR CHEMICAL COMPOSITION AND PHYSICAL TESTS FOR RAILS.

Under date of July 12th, your sub-committee sent out a circular of inquiry to 123 companies operating 100 miles and upward of track, each as to chemical specifications and physical tests prescribed by rail buyers.

Your sub-committee has given but little attention to the question of rail manufacture and makes no recommendations at this time.

It may, however, be interesting to note the main points in the replies to the circular that have been sent in to date.

Twenty-two replies were received, which show that nine companies buy on manufacturers' specifications.

3 of them are satisfied.

2 companies find the rails too soft.

1 company is troubled with corrugations.

3 make no comments.

Two companies use the specifications of the A. S. of C. E.

1 finds the rails satisfactory.

1 reports a poorer quality than in former years.

Two companies use specifications of the A. Ry. Engr. & M. W. Association and find them satisfactory.

One company uses the specifications of the The Am. Soc. for Testing materials and makes no comment as to results.

Eight companies use specifications varying from these above noted.

4 of them are comparatively low in carbon, phosphorus and sulphur, ranging between 0.45 to 0.55 for carbon; 0.06 to 0.10 for phosphorus; 0.047 to 0.09 for sulphur.

3 of these are satisfied with results and one reports corrugation.

3 of the 8 specify rails comparatively high in carbon, ranging between 0.57 to 0.75 for carbon; 0.06 to 0.09 for phosphorus and sulphur.

One company recommends an increase of manganese to 3 per cent. whereas 1.2 per cent. is the maximum for all other specifications noted.

Two companies believe rails made by the open hearth process would be much better.

One company calls attention to the fact that the old rails which were always low in carbon were still very much better than rails of recent manufacture and recommend rolling between temperatures of 1,700 degrees to 1,000 degrees Fahr. and finishing at the lower temperature without artificial cooling.

In the old practice rolling occupied from six to eight minutes, which in the modern mill is now completed in two minutes.

Suggest miscroscopic test for fineness of structure and greater severity in the drop and bending test.

In the matter of physical test, five companies prescribed a drop test with 2,000 lb. tup, each, however, varies from the other ranging from a drop of fifteen feet on to rails three feet between supports to twenty feet, four feet between supports for eighty pound rail and twenty-two feet for rails of 100 lb. per yard.

As the most complete and best of rail specifications furnished to your sub-committee, responsive to the circular letter, that of the N. Y., N. H. & Hartford R. R. Co. for 1905, revised for 1907, submitted by the Connecticut Railway & Lighting Co., is copied here in full.

## NEW YORK, NEW HAVEN AND HARTFORD RAILROAD COMPANY, 1905.

### STANDARD SPECIFICATIONS FOR STEEL RAILS.

### SECTION.

(1) The section of the rail shall conform to the dimensions shown on the drawing attached or designated, with an allowance in height of 1/64 of an inch under, and 1/32 of an inch over, permitted on a delivery of 10,000 tons. The fit of the fishing or "male" template shall be maintained perfect.

(2) The weight of the rail will be maintained as nearly as possible, after complying with paragraph No. 1 to that specified in the contract.

### LENGTH.

(3) The standard length of the rail shall be 33 feet at a temperature of 60 degrees Fahr. Ten per cent. of the entire order will be accepted in the shorter lengths of 30 feet and 27 feet only. and all No. 1 rails less than 33 feet long shall be painted green on the ends.

### FINISH.

(4) The rails must be free from all mechanical defects and flaws, and shall be sawed square at the ends and the burrs made by the saws carefully chipped and filed off, particularly under the head and on top of the flange. The rails shall be smooth on the head; straight in all directions, both surface and line, and without any twist, waves or kinks, particular attention being given to having the ends without kinks or drop. The hot-straightening shall be carefully done, so that

gagging under the cold press shall be reduced to a minimum, and so applied that the rails shall not be made "lumpy." No. 1 rails must be free from injurious defects and flaws of all kinds.

### DRILLING.

(5) Drilling for bolts shall be in strict conformity with the drawing attached or the dimensions designated herewith. These holes must be accurate in every respect, and finished without burrs.

### BRANDING.

(6) The weight of the rail, the name of the maker, and the month and year of manufacture, shall be rolled in raised letters on the side of the web, and the number of the blow and the letters "N. Y., N. H. & H." shall be plainly stamped on each rail, where they will not be subsequently covered by the splice bars.

### QUALITY.

(7) The rail must be hard, sound and tough, showing a fine dense grained metal on fracture.

### COMPOSITION.

(8) The chemical composition of the rail shall be as follows for 1907:

| | *80-pound*<br>*Per cent.* | *100-pound*<br>*Per cent.* |
|---|---|---|
| Carbon | .57 to .65 | .60 to .70 |
| Phosphorus shall not exceed | .07 | .07 |
| Silicon shall not exceed | .20 | .20 |
| Manganese | .80 to 1.05 | .80 to 1.05 |
| Sulphur | .06 | .06 |

### HEAT TREATMENT.

(9) The number of passes and speed of train shall be so regulated, that, on leaving the rolls at the final pass, the temperature of the rail will not exceed that which requires a shrinkage allowance at the hot saws of 5.75 inches for 80-lb., and 5⅞ inches for 100-lb. rails, and no artificial means of cooling shall be used between the final pass and the hot saw.

### DROP TESTS.

(10) A rail-butt from each blow shall be placed either head or base upward on solid steel or iron supports four feet apart in the clear, and upon it shall be dropped a weight of 2,000 pounds, falling freely from a height of 20 ft. for 80-lb., and 22 ft, for 100-lb. rail. If any rail break when subjected to the drop test, two additional tests will be made of other rails from the same blow of steel, and if either of these latter tests fail, all of the rails of the blow which they represent will

be rejected, but if both these additional test pieces meet the requirements, all of the rails of the blow which they represent will be accepted.

(11) All test pieces shall be taken from the top of the ingot.

### Treatment of Ingots, Etc.

(12) After the ingots are cast, they shall be either constantly kept in an upright position until ready to be rolled, or else so maintained until the interior steel has had time to solidify.

(13) No "bled" ingots or ingots from "chilled" heats shall be used in the manufacture of rails under this contract.

(14) No ingots from badly-teemed heats shall be used, excepting as they shall be subject to the provisions of section 18.

(15) After cutting off or allowing for the "sand" on top end of each ingot, at least 12 inches more of seemingly solid steel shall be cut off that end of the bloom — a greater length than 12 inches being preferred; and if, after cutting such lengths the steel does not look solid, the cutting shall continue until it does.

### Heating.

(16) Care shall be taken to avoid over-heating the steel, and, under no circumstances shall a "cinder" heat be allowed — that is, a heat high enough to cause the cinder to run off the steel as it is being drawn from the furnace. This does not apply to cinder which may be sticking to the under side of the steel when drawn from a horizontal furnace, or to the bottom of an ingot when drawn from a soaking-pit.

### Inspection.

(17) Inspectors representing the purchaser shall have free entry to the works of the maker at all times while this contract is being filled, and shall have all reasonable facilities afforded to satisfy them that the rails are being made in accordance with these specifictions. The makers shall furnish them with the carbon determinations of each heat, and a sufficient number of complete analyses to represent the average steel of each day's work.

(18) The inspectors shall have authority to reject rails made from insufficiently sheared blooms, or from heats, the test pieces or drop-tests of which have failed, or from badly poured heats, or from "chilled" heats or from "bled" ingots. The rails made from insufficiently cut blooms, if otherwise perfect, to be afterward received as No. 1 short rails, if sufficient lengths have been sawed off to make an amount of steel equal to the original demand of 12 inches. The rails made from heats, the drop tests of which have failed, may be accepted as No. 2 rails. The rails from a badly poured heat may be received as No. 2 rails, but if made from a "chilled" heat or "bled" ingot, are to be absolutely rejected.

By a badly poured heat is meant one which from any cause has been teemed without the control of the operator.

A "chilled" heat is one which by reason of the chilling of the steel has to be either pricked or poured over the top of the ladle.

A "bled" ingot is one from the center of which the liquid steel has been permitted to escape.

(19) Rails imperfectly drilled or straightened (except lumpy rails) or rails imperfectly chipped or filed shall be rejected, but will be accepted after being properly finished.

(20) Rails failing to comply with paragraph 1 will be rejected as No. 1 rails.

### No. 2 RAILS.

(21) The requirements for No. 2 rails shall be the same as for No. 1 except that they will be accepted with a flaw in the head not exceeding 0.25-inch, and flaws in the flanges not exceeding 0.5-inch in depth, and may have been made from an imperfectly poured ingot, or from heats of which the drop tests have failed.

(22) No. 2 rails to the extent of 5 per cent. of the whole order will be received at a price of 5 per cent. less than that paid for No. 1 rails. All such rails must be painted white on ends and kept separate from No. 1 rails.

EDWARD GAGEL,
*Chief Engineer.*

Approved:
E. H. MCHENRY,
*Fourth Vice-President.*
New Haven, Conn., November 23, 1905.

## CIRCULAR LETTER SENT TO RAILWAY COMPANIES.

THE AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION.

SUB-COMMITTEE ON RAILS AND JOINTS.

COLUMBUS, OHIO, *August* 13, 1907.

To ..............................
..............................

I am sending you herewith thirteen sheets of blue prints illustrating standards proposed by the Sub-committee on Rails and Joints of the American Street and Interurban Railway Engineering Association for Trilby Girder, Tram Girder and Girder Guard Rail sections for use under urban conditions in paved streets.

Where Tee rails are acceptable to the city authorities it was thought that the Lorain Steel Co.'s Section 95-400 or Pennsylvania Steel Co.'s Section 272, which are identical would be satisfactory and that new designs of Tee rails were not necessary.

We would be glad to hear your criticism of the new sections proposed or any suggestions which you may care to make.

An early reply is desired.

Respectfully,
JULIAN GRIGGS, *Chairman,*
*Sub-Com. on Rails and Rail Matters.*

NOTE — Please forward all answers to Julian Griggs, Columbus, O.

### DATA SHEET SENT TO RAILWAY COMPANIES.

### THE AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION.

### SPECIFICATIONS FOR RAILS.

COLUMBUS, OHIO, *July* 12, 1907.

*To the General Managers and Engineers of Street and Interurban Railway Properties in America:*

The ....................................
....................................

For study and comparison, with a view to an ultimate improvement in the quality of steel rails, your committee desire a copy of the Specifications of your Company for the manufacture of rails, and solicit an early reply giving information on the following points:

*First.* Chemical Composition. What are your requirements?......
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..............................................................
..............................................................

*Second.* Physical properties or tests. What are your requirements?
..............................................................
..............................................................
..............................................................

*Third.* Is the quality of rails supplied satisfactory, if not, what are the defects? ..................................................
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..............................................................
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*Fourth.* What change in chemical composition, if any, do you suggest? Why? ..........................................
..............................................................
..............................................................
..............................................................

*Fifth.* What change in physical test requirements would you recommend? Why? ..........................................
..............................................................
..............................................................
..............................................................

Duplicate blanks are sent herewith for the files of the Company replying.

THE AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION.

By

JULIAN GRIGGS, *Chief Engr.*,
Scioto Valley Traction Co., Columbus, Ohio.
CHAS. H. CLARK, *Engr. M. W.*,
International Railway Co., Buffalo, N. Y.
E. O. ACKERMAN, *Engr. M. W.*,
Columbus Ry. & Light Co., Columbus, Ohio.
*Sub-Committee Appointed by Committee on Way Matters, A. S. & I. R. E. A.*

SIGNATURE ..............................
TITLE ..............................

NOTE:— Please forward all answers to Julian Griggs, Columbus, Ohio.

In conclusion Mr. Clarke said:

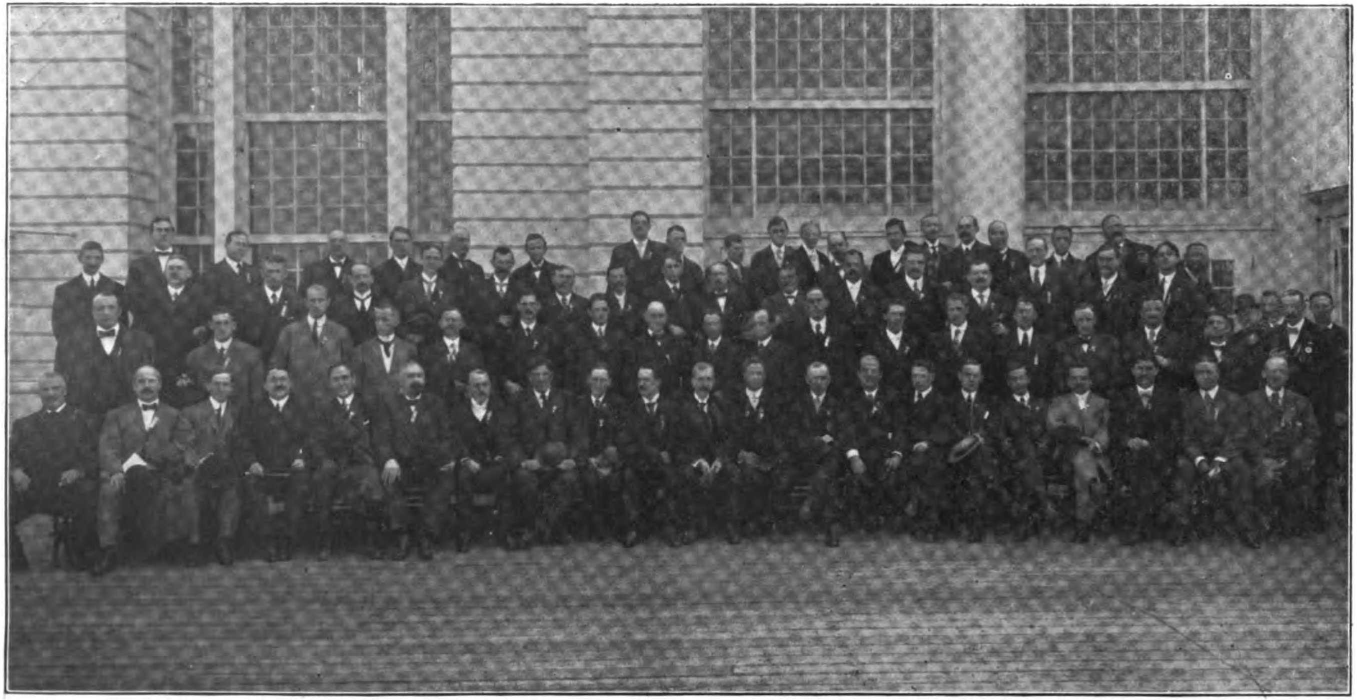
We say in our report, substantially, that the selection of the best type of rail is up to the city — if the city will let us we will put in the best type of rail, but we do not say definitely that it is the best construction. We therefore desire to amend our report so as to make it read as follows: Your Sub-committee on Rails and Joints, as a result of its study recommends as the best practice, and as standard for city construction in paved streets, the use of a 7 inch Tee rail known as the Lorain Section No. 95, 400 and the Pennsylvania Steel Company's Section, 272.

MR. SIMMONS:— In connection with the reading of that report I desire to say for the benefit of the members that of course the report will be pubished and circulated. This report is simply a report of progress. The proposed change which Mr. Clark read in the first paragraph of the report has the approval of the Way Committee. In other words, the Way Committee believes that the report of the Sub-committee on Rails, if it is making a definite recommendation, should be a recommendation that this certain section of Tee rail for use in paved streets is recommended *as best practice*, without regard to the fact of whether or not certain cities permit the use of it. The report goes on to provide for those cities where the use of Tee rail is not permitted, due to various reasons, probably the city engineer's idea and the ideas of those unfamiliar with the science of the question. Other types of rails are provided, the effort being to reduce these types to some reasonable minimum. We know that at present there are probably anywhere from 50 to 100, or possibly more, types of rails, being used in various cities, each city to a greater or lesser extent having a type of its own. Now, if we can reduce these to two or three types, varying only in height or weight, to suit local conditions, we will have provided for those cities where these particular conditions prevail, but we do wish to recommend the use of Tee rail as being the best practice.

PRESIDENT ADAMS:—Mr. Simmons' remarks on this report cover what I had in mind to say. We hardly have the time to throw the subject open for discussion, as we desire to get back this afternoon for a very important session which we are going to have on the standardization of equipment; and if there is no objection we will let this report stand as a report of progress, with the understanding that the same will be printed in the proceedings in full.

I will at this time announce the Committee on Nominations: C. H. Clark, Buffalo, Chairman; George L. Wilson, Minneapolis; Charles Hewitt, Philadelphia; George J. Smith, Kansas City; W. D. Wright, Providence, R. I.

The meeting then adjourned until 2 P. M.



1907 CONVENTION PHOTOGRAPH.

# TUESDAY AFTERNOON SESSION.

## OCTOBER 15, 1907.

President Adams called the meeting to order at 3 P. M.

**PRESIDENT ADAMS**:— The session is, as usual, a little delayed because of the late luncheon we get here in Atlantic City, but you will have to make the best of it. The first business for this afternoon is the report of the Committee on Standardization. The report has been printed, but it has not been out long enough to have been of very much service. However, the committee in following this matter up has endeavored to have the proceedings of its meetings published in the technical press, so that I presume you are all more or less familiar with the subject this committee has to present. I am going to ask Mr. Evans to present this report; but before this is done, I believe Mr. Clark desires to make an announcement with reference to his Nominating Committee.

**MR. CLARK**:— I would like to have the members, Mr. Wilson, Mr. Hewitt, Mr. Smith and Mr. Wright meet in room 102, Haddon Hall, to-morrow at 11 o'clock.

**PRESIDENT ADAMS**:— Mr. Evans, if you are ready, we would be glad to have you present the report to the meeting. I would suggest, gentlemen, that in the presentation of this report Mr. Evans present the main preliminary remarks, and possibly the conclusions of the report, then we can take up the subject topic by topic and discuss each in turn, and then take up the question of the adoption or rejection of it after we have gotten through with the discussion. In that way we will make best progress, and if there is no objection we will proceed in that manner.

The report in full is as follows:

## REPORT OF THE COMMITTEE ON STANDARDIZATION.

Your Committee on Standardization begs to submit the following report:

Your committee appointed to investigate the subject of standardization as applied to electric traction equipment has proceeded upon the lines laid down for this committee in the year 1906, and has investigated the same topics, namely:

(a) Standard axles, journals, journal bearings and journal boxes.
(b) Standard brake shoes, brake shoe heads and keys.
(c) Standard section of tread and flange of wheel.
(d) Standard rails.

Considerable work on all of the above subjects was done by the committee during the year 1906, both previous and subsequent to the convention at Columbus, and all the information given in the data sheets was compiled in tabular form for consideration by the committee.

It was subsequently decided desirable to have the subject of rails considered by the Way Committee. All the information received on this subject was turned over to that committee by direction of the president, and that committee will submit a separate report. This committee has considered the subject of rails and special work only as affecting the recommendation of a standard wheel tread and flange.

In order thoroughly to study the conditions affecting the above subjects, the committee held meetings in New York on May 20 and 21, in Cleveland on July 26 and 27, and again in New York on September 12 and 13, 1907. At each of these meetings representatives of the various manufacturers of all the equipment under consideration were present, and materially assisted the committee in arriving at the recommendations which are embodied in this report. Abstracts of the discussions at these meetings have been printed and widely circulated and this has resulted in a favorable sentiment toward the subject of standardization. The committee appends the stenographic reports of its meetings, blue prints, and other information obtained bearing on the subjects under discussion.

## (a) STANDARD AXLES, JOURNALS, JOURNAL BEARINGS AND JOURNAL BOXES.

A consideration of this subject disclosed that it would be very difficult to adopt standards which would accommodate, to any general extent, the equipments already in service. After a thorough discussion by the representatives of all the interests involved, this committee decided to recommend arbitrary dimensions which conform to what is believed to be the very best recommended practice, at the same time meeting as nearly as possible the requirements of the existing conditions. The dimensions proposed very nearly approach the standards adopted by many of the large electric railway properties of the country.

In this connection the committee has profited very materially by the experience of similar organizations which have developed the axle problem since the beginning of operation of railroads in this country, and this was found to be not only valuable in taking advantage of what experience had taught, but also desirable from a commercial standpoint.

We, therefore, recommend the axles shown in Fig. 1 and designated as EA, EB, EB-1, EC, EC-1, and ED. A general summary of the axle and gear data is given in Table I.

TABLE I. SUMMARY OF AXLE AND GEAR DATA.

| TYPE. | Journals, inches. | Motor fit, inches. | Gear fit, inches. | Wheel fit, inches. | Distance between hubs. | Centers of journals. | Maximum capacity. | Horse-power. | Length of gear seat. | Gear pitch. | Gear face, inches. | Diameter of gear hub and motor bearing flange. | Finished width gear hubs. Wheel side. | Finished width gear hubs. Motor side. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EA.......... | 3¾ by 7 | 4½ | 5½ | 5 7-16 | 48 | 75 | 15,000 | 45 | 6⅛ | 3 | 6 | 8 | 1 | ⅛ |
| EB.......... | 4¼ by 8 | 5 | 6 | 5 15-16 | 48 | 75 | 19,000 | 45– 65 | 6⅛ | 3 | 5 | 8 | 1 | ⅛ |
| EB1.......... | 4½ by 8 | 5½ | 6 | 5 15-16 | 48 | 75 | 22,000 | 65–100 | 6⅛ | 3 | 5 | 8 | 1 | ⅛ |
| EC.......... | 5 by 9 | 6 | 7 | 6 15-16 | 50 | 76 | 27,000 | 100–150 | 6⅛ | 2½ | 5½ | 9½ | ⅛ | ⅛ |
| EC1.......... | 5 by 9 | 6½ | 7 | 6 15-16 | 50 | 76 | 31,000 | 150–200 | 6⅛ | 2½ | 5½ | 9½ | ⅛ | ⅛ |
| ED.......... | 5½ by 10 | 7 | 8 | 7 15-16 | 50 | 77 | 38,000 | 200–250 | 6⅛ | 2½ | 5½ | 10½ | ⅛ | ⅜ |

Axle EA has a journal of 3.75 by 7 in. It is designed to carry a load of 15,000-lb. per axle and for the accommodation of motors not to exceed 45 h.p. capacity.

Axle EB has a journal 4.25 by 8 in. and is designed to carry a load of 19,000-lb. per axle and for motors not to exceed 65 h.p. capacity.

Axle EB-1 has the same general dimensions as axle EB, except that it is 5.5 in. in diameter at the motor fit. It is designed to carry 22,000-lb per axle and for motors not exceeding 100 h.p. capacity.

Axle EC has a journal 5 by 9 in. It is designed to carry a load of 27,000-lb. per axle, and is intended to accommodate motors not to exceed 150 h.p. capacity.

Axle EC-1 is of the same general dimensions as axle EC, excepting that the diameter at the motor-fit is 6.5-in. It is designed to carry 31,000-lb. per axle and to accommodate motors not exceeding 200 h.p. capacity.

Axle ED has a journal of 5.5 by 10 in. and a carrying capacity of 38,000-lb. per axle. It is designed to accommodate motors not to exceed 250 h.p. capacity.

Axles EA, EB and EB-1 are to accommodate motors that do not require more than 48-in. between the wheel hubs, and axles EC and EC-1 and ED are to accommodate motors that do not require more than 50-in. between the wheel hubs.

Particular attention is directed to the dimensions given on these axles, all of which were worked out with a great deal of care by the committee and were adopted only after a very careful consideration of each and the relation of each to all the others. This applies with particular emphasis to the diameter and length of wheel-fit, diameter and length of gear-fit, the gear keys and the diameter of the motor-fits. The discussion in connection with these subjects developed that the dimensions recommended by the committee are the most desirable and very acceptable to the manufacturers of the different parts of the equipment. Their original adoption will result in eliminating a great variety of dimensions of these parts. This lack of uniformity in the past has worked a particular hardship, not only on the manufacturers, but also upon the companies operating the equipment.

Special attention is directed to the length of gear seat and the key way, as well as to the diameter of the gear hub and the width of gear face, as it was found that by adopting these dimensions, the motor builders would be able to arrive at a uniform gear practice.

It is further recommended that for motors not to exceed 100 h.p., a three-pitch gear with 5-in. face be adopted as standard; and that motors exceeding 100 h.p. should have a 2.5-in.-pitch gear with a 5.25-in. face.

### JOURNALS AND JOURNAL BEARINGS.

For journals and journal bearing keys we recommend the use of the four sizes known as the Master Car Builders' standards. These

are the result of years of experience in equipments of similar character and generally familiar, and are specified in reports of the proceedings of that association.

### JOURNAL BOXES.

In connection with the axles already recommended, we submit herewith Figs. 2, 3, 4, and 5, showing journal boxes for each of the different journals recommended, showing two styles of design for the tops of the boxes to accommodate the two styles of trucks generally used in electric traction equipment. The interiors of these boxes are arranged to accommodate the journal bearing keys referred to above and will be subject to the test gages in common use for journal boxes of this character.

### (b) BRAKE SHOES, BRAKE SHOE HEADS AND KEYS.

Your committee believes that this feature of the equipment most readily permits of standardization and that the results obtained therefrom, both mechanically and commercially, will be most desirable.

The data sheets compiled by your committee show that at the present time there are innumerable styles and patterns of brake shoes and brake heads in use throughout the country, many of which vary but slightly from the recommendations which your committee herewith submits.

For wheels having a tread of 3-in. wide and over, your committee recommends a design of brake head and shoe (see Figs. 6 and 7), both of which are interchangeable with those in general use in steam railroad practice. The brake head recommended is adapted to both the flanged and unflanged shoes. The unflanged shoes to go with this head are reversible on their own wheels, and the flanged shoes may be reversed by changing the shoe from end to end on the brake beam.

To accommodate wheels in service, with treads narrower than 3-in., the committee deems it advisable to recommend the second brake head and shoe illustrated in Fig 8. This head is adapted for use on any of the narrower tread of wheels, viz., those less than 3-in. wide. The brake shoe can be used either flanged or unflanged, the unflanged shoe being reversible upon the same wheel and the flanged shoe will be reversible by changing it to the other end of the brake beam, thus requiring but one pattern of brake shoe for all equipment which will be standardized with this brake head.

No attempt has been made at this time to suggest a standard for the brake head hanger arrangement, as the patterns submitted are simply for the brake shoe attachment. For the brake head shown in Figs. 6 and 7, it is intended to use the brake shoe key now in general use.

### (c) STANDARD SECTION OF TREAD AND FLANGE OF WHEEL.

The investigation by this committee of the various types of wheels in service on electric traction properties throughout the country shows that there is a very wide variation of wheel sections in use, especially as regards flanges and treads. An inspection of the data sheets demonstrated that it was almost impossible to select one wheel which would meet all the varying conditions. These sheets also showed conclusively that wheels of a considerably narrower tread than the increased weight of the equipment requires are being operated. Your committee, therefore, recommends as standard for street and interurban railways as far as it can be applied, a wheel tread and flange contour which conforms to that shown in Fig. 9 and indicated as Wheel A, this wheel to have a tread 3-in. wide and a flange ⅞-in. high and 1 3/16-in. thick at the throat. It is the opinion of the committee that this wheel tread and flange can be applied with comparatively little difficulty to a great majority of the roads forming our association.

A number of roads are using wheels with a tread 3.5-in. wide for combined city and interurban work, and there is a decided tendency in this direction. This wide tread assists in carrying the load across special work without running on the flange, and avoids the necessity for flange bearing on the special work. We, therefore, also recommend Wheel A with the tread increased to 3.5-in. for interurban work, and also for city work where it can be used. In the judgment of your committee, it is especially desirable to work toward the general adoption of wheels having this tread.

Your committee recognizes the fact that local conditions on many of the systems forming our association are such that it will be difficult for a number of years to operate a wheel of the dimensions represented by Wheel A. To meet these conditions your committee recommends Wheel B (Fig. 9), with a tread of 2.5-in. wide and a flange 0.75-in. high, this flange to have the same general dimensions as Wheel A with the exception of the height above the tread line.

In mounting and gaging wheels it is understood that the gage line is at a point on the flange 0.25-in. above the wheel tread, and your committee recommends that the wheels be gaged 0.25-in. narrower than the gage of the track, the track gage being measured between points 0.25-in. below the tops of the rails.

## RECOMMENDATIONS FOR FUTURE WORK.

The investigation conducted by this committee during the past two years indicates the need on the part of the association in the future for a standing committee or standing committees to take charge of the changes and progress in electric traction equipment. The extent of the field suggests the desirability of dividing the subject among various committees as has been found necessary in the case of similar work carried on by other associations.

## CONCLUSION.

In making these recommendations, your committee has been greatly assisted by representatives of the manufacturers of the various parts

of the equipment concerned, and it is pleasing for us to report that these recommendations appear to meet with their general approval. In fact they will gladly coöperate in the adoption of these standards, as many of the various manufacturers represented in our conferences have long felt the necessity for the adoption of standards for electric traction equipment. It is possibly well to state that these recommendations are the result of a very thorough and general discussion on the part of all the interests involved, both the manufacturing and various departments of the electric railways. Your committee takes this occasion to acknowledge the very valuable assistance and enthusiastic support of all those who coöperated in the work leading up to these recommendations.

The recommendations of this committee are the result of the labor of two years and we urge that definite action be taken in this matter at your convention this year.

Respectfully submitted,
W. H. Evans, *Chairman,*
H. Wallerstedt,
J. M. Larned,
H. B. Fleming,
R. C. Taylor,
H. A. Benedict,
H. W. Blake,
C. B. Fairchild, Jr.,
*Committee on Standardization.*

Mr. Evans:— I think, Mr. President, as insufficient time has elapsed since the printed copies of the report have been distributed to give all a chance to look them over, it might be well to just make a synopsis without going to the trouble of reading the entire report. However, as considerable space is taken up with the drawings and prints, it is not as extensive as it might appear; I will therefore read portions of the report. I might say in passing, Mr. President, that the distinguishing feature, in fact the only variation in dimensions, as between the axles indicated as EB and EB-1, and also in the case of EC and EC-1, is the diameter of the motor fit, as it was originally thought best to recommend axles 5.5 inches and 6.5 inches for those two sizes; but after further consideration it was considered desirable to specify a particular axle which would have a 5 inch and also a 6 inch motor fit, so that we really have adopted but four standard axles with that particular variation. The journal boxes are illustrated in the drawings, and I think, while we did not intend them to constitute working drawings, the principal dimensions are supplied and the detail dimensions can be obtained from the Master Car Builders' standard drawings where we have shown them in this report.

PRESIDENT ADAMS:— Gentlemen, that is the report of the most important committee which this association has had. I have followed the work of this committee closely. I was invited by the committee to be present at its deliberations, and in order to tell you the way this committee worked, I want to state that at the last meeting they had in New York I left them at 20 minutes past 11 to take the midnight train for Baltimore. I understand that the committee broke up at 1 o'clock, and then continued the next morning — Saturday morning — and completed the report. That is just an example of the way the members of this committee have put their shoulders to the wheel on this subject. They deserve the utmost credit for the report they have presented. I will now turn it over to you for discussion, taking up the subject of axles. I might mention, gentlemen, that we have a number of the representatives of the manufacturers here in addition to the representatives of the main association. This discussion is thrown open to you all.

### *Discussion of the Report of the Committee on Standardization.*

MR. STORER:— Mr. Chairman, it was my good fortune to be called in by the committee to represent the Westinghouse Electric & Mfg. Co., on this axle problem in particular. There were two points there which directly concern us as manufacturers of railway motors: The first is the distance allowed between the wheel hubs; and second the length of the gear fit. The report which has been finally adopted is satisfactory to us, although not exactly in accordance with our recommendations. We understand fully that the conflicting requirements of the truck builder, the wheel manufacturer, and the motor builders don't always conduce to the very best in any particular part. We believe that the report as adopted gives the best compromise for all concerned.

There is one point which I wish to call to your attention, that of the gear fit, and especially to the position of the gear face with reference to the flange of the wheel or to the position of the motor on the axle. It was determined by the committee that this gear face should be in a standard position on the different axles in order that motors of different manufacture could be placed on any axle; that is, that the motors would be interchangeable as far as gears and axles are concerned. That, I think, is one of the most important decisions arrived at in connection with the subject. One little point I believe it would be advantageous to change. It was due to an oversight on the part of our representative at the meeting in New York, and that is the overhang of the gear hub on the gear for the axles having 48 inches between the hub. We would like very much to see the gear hub flush on the motor side of the gear, and have the 1⅛ inches overhang on the wheel side. The gear would then be the standard which is in use on a great many of our motors — many thousands of our equipment are built in that way, and I understand that this gear having ⅛ overhang on the motor side is not in use at present by any motor in the country. It is a small matter of ⅛ inch and I would like very much to have the committee consider that at their next meeting if it is possible to make that slight modification.

President Adams:— Mr. Priest, can you say something in connection with the point that Mr. Storer has just raised, as to whether there is any objection to changing that dimension? This will be found on page 5, table 1, the last two columns, "Finished width of gear hubs; the wheel side and the motor side" the first three axles in this report, call for 1 inch on the wheel side and on the motor side ⅛ inch. Mr. Storer proposes that the dimension be 1⅛ inch on the wheel side and flush on the motor side.

Mr. Priest:— I am not prepared to advise. Possibly it will be all right. I would like to investigate before making any definite recommendations.

Mr. Evans:— Mr. Chairman, the point which Mr. Storer has raised is, I think, quite a good one, since it corresponds with a large number of equipments which they already have in service; but we thought that since the representatives of both the Westinghouse and the General Electric companies had been at our previous meeting, and since Mr. Priest and his assistant Mr. Schermerhorn, who acted in his absence, did not give their enthusiastic support to the proposed changes by Mr. Storer, it would be well, Mr. President, to carry this over until after the convention, and in the meantime we could possibly harmonize any difference between the two designing engineers of the General Electric and Westinghouse companies. And I just want to say, Mr. President, while I am speaking, that we appreciate very much the fact that the General Electric and the Westinghouse Electric & Mfg. Co. so enthusiastically sent their representatives, both Mr. Storer and Mr. Priest, who I am sure are very busy men, and also their representatives, to confer at our meeting. I think that Mr. Schermerhorn and Mr. Webster had a session until long after midnight one evening, that I remember, and I think Mr. Storer will be able to take care of that very nicely.

PRESIDENT ADAMS:— This particular point is a small point which affects the gear design, and I suggest that it be left for consideration in next year's report, this being a standing committee.

MR. OLDS:— Mr. President, it gives me a great deal of pleasure to say that I give the report of this committee my hearty support. Some of the axles recommended are those we have used for a number of years in Milwaukee. Only one is new. There is a little difference in the diameter of the wheel fit of our standards, but that is a mere detail, and one that I can readily change to meet their recommendations. As I have stated at our previous meetings, I think it a matter of very great importance to our companies that we adopt standards. By so doing we will be able not only to get better equipments, but will make it possible, if we see fit, to change one type of motor on a truck to another at small expense. As the matter now stands, they are of different dimensions, but, as I stated a moment ago, the general dimensions are Milwaukee standards.

President Adams:—We have not heard anything from any of the representatives of the truck builders. We have a number of them with us. I do not know whether they feel that they had their say when the committee was in session or not. If there is anything they would like to say in connection with the report we would be very glad to hear from them.

Mr. Ayres:—I was going to rise, Mr. Chairman, and then I thought I would not, that I would wait until the truck people had had their say. I suppose it is hardly necessary to state that it is more important to get these things standardized than it is to get just the best possible dimensions, and in what I am going to say I do not want even to suggest that the committee ought to change any of these dimensions; at the same time, I must say, that when I saw these axle dimensions I did not like the appearance of them, simply because they are so far from our practice on the Boston & Worcester Street Railway. Now, as I understand it, the purpose of making the diameter of the axle at the gear seat considerably larger than the diameter at the motor bearing is to get room for the keyway and to get increased strength to make up for the weakening of the axle which comes from cutting the keyway. I should think that the diameter of the axle at the wheel fit is dictated with reference to the idea of getting that just a trifle smaller than the diameter at the gear seat. Now, on our road the practice is to have practically only two diameters for the axle altogether, one diameter at the journal box, and the rest of the axle one other diameter. On our smallest size of interurban equipment we use the G. E. 57 Motor and use an axle 4½ inches in diameter everywhere except at the journal. There is no keyway; the gear is pressed on and the wheel is pressed on. The fact that the keyway is omitted seems to me to remove the reason for having the axle large at that point. In our larger equipment we use a 5.25 inch axle, 4.25 inch at the journal box and 5.25 inch everywhere else. Some of the truck manufacturers have objected that you cannot press on a gear over the wheel fit and have them both of the same size. That is a mistake; we do it in our shop right along; it is entirely satisfactory and they do not get loose. Of course, the practical advantage of that form of axle is that it is cheaper to make, especially perhaps in the shops of an operating company. Now, there may be some reason for increasing the size of the axle at the wheel fit, some reason in connection with the strains in the metal and the necessary strength. I do not see any such reason. Of course most broken axles fail — at least in our experience practically all of them — at the wheel hub, at the end of the keyway. We never have had axles break there since we adopted our present construction, because we have no keyway in them. This is a recent standard with us, and we may not have had them in use long enough to fully ascertain their character. It has been my opinion that it was the keyway in the axle that caused the strains to accumulate at that point, and caused the axle to break there. I am not sure that a larger axle, an axle increased in diameter at that point, is any stronger, or even as strong as the axle of uniform diameter throughout its length. It is certain, I think, that the bending to which any axle or shaft is subjected has a tendency to localize at a point where there is a sudden change in diameter, and at a point where the metal has been cut for any reason. The keyway is worse than a change in diameter.

Probably where the wheel is pressed on with a great many tons of pressure the localization may take place at the end of that hub just as it would if the axle itself were suddenly enlarged at that point; but I am inclined to think that there is less danger of having so-called crystallization, the straining of the fibres of the metal, in a case where there is a sudden increase of diameter due to the pressing on of an exterior collar of metal, that is, the hub, than there is in the case where the increased diameter is made by turning it out of the solid axle.

I do not know that I want to raise any objection to the report of the committee. I simply wanted to present my point of view, that it does not seem to me that for high speed work keyways ought to be used. I think we all agree that for high speed work the solid gear should be used, and there certainly is no need of a key at all with solid gears. There is no more reason for a key with the gear than with the wheel. They can be pressed on so they will not move. It seems to me where that fact is taken into account the need of the increased diameter of the axle at the wheel seat and gear seat disappears. I think that is perhaps all I have to say except to make the remark that it is evident in some instances that it will not be possible to use for a long time the standard dimensions, and they probably never will be used where open cars are used in city streets, where very short radius curves have to be taken, because the length of the bearing has to be kept down below the standard here indicated in order to make the truck narrower and have it swing freely, without striking the running board.

Mr. Dickey:—With respect to that point I would like to say that with all forms of gears the enlarged gear seat appears to be necessary. For instance, we recently made the attempt, in meeting the requirements of a customer, to force a gear with manganese rim and cast iron center over a 5 inch straight axle for a keyless fit. After the gear had traversed the wheel seat the pressure was too low to permit of dispensing with a key. The only gear that can be utilized at all for such a fit is one of cast steel and even with a gear of that metal you are not very sure of having sufficient pressure when the gear has reached its seat.

Mr. Ayres:—If it is necessary it can only be a small amount, such as 1/16 of an inch, to accomplish that.

Mr. Dickey:—That is all we allow.

Mr. Ayres:—One-sixteenth of an inch thicker than the rest of the axle?

Mr. Dickey:—We allow 1/16 inch larger gear fit than wheel fit and thereby relieve the gear of all expansion due to pressing it over the wheel seat. It is put right onto the gear seat with the first pressure.

President Adams:—All things considered, it is going to be difficult to reconcile a report of this character to the practice of every individual road, and the report of this committee is a report of the practice best recommended. I state this because I suppose we could all get up and say that we would rather have such and such practice — I do not say this with any discourtesy to Mr. Ayres — but it is a thought which came to me and I desire to set the committee straight as far as they were concerned in their recommendation.

We have with us a number of the representatives of the American Association, and I do not know whether or not they have had an opportunity to read this report, but I should be pleased to hear some expression of opinion from them. Mr. Sergeant, will you honor us with a few remarks?

MR. SERGEANT:— I will have to ask to be excused. I am here merely as a looker-on. I also have a very bad cold, and if I had anything to say of any importance I could not very well say it to you. I would say, however, that I suppose every committee on standardization has always encountered the difficulty that nothing is standard, and that standards cannot be adopted in practice until a long time after they have been adopted in theory. But, Mr. President, it seems to me that unless you can suggest standards to work toward, we should never arrive anywhere, and I believe that in almost every department of electrical railway work we have suffered for years from a lack of standards. Without being able to discuss this from a technical point of view, I sincerely hope, that it may result in our approximating to something that will become standard in regard to all these matters.

MR. CONNETTE:— In looking over the standards recommended for axles, I am reminded of a road in eastern Massachusetts which had two or three accidents on account of loose wheels, that were caused by the depth or length of the hub of the wheel being less than the diameter of the axles. They sued the wheel manufacturer to recover the amount which they had to pay on account of the accident, claiming it was the fault of the wheel manufacturer who furnished the wheels and axles; but it developed in the course of the lawsuit, that the wheels and axles were made from drawings that were furnished by the street railway company. I notice that axles EA and EB provide for a length of hub of 7.5 inches, — they are the smaller sized axles — while the two larger sized axles provide for a hub 6.5 inches in length. The diameter of the axles are, EC, 6 15/16 inches and the larger one, or

ED, 7 15/16 inches in diameter. I beg to inquire of the committee if it considers this good practice?

Mr. Evans:— In answer to what Mr. Connette has said, I would advise that that difficulty occurs from a rather selfish motive on the part of the motor designers, and that it required considerable argument to get them to release as much as 50 inches of the axle, as they wanted 51 and 51.5 inches; but we were fortunate in calling to our assistance the truck builders, wheel manufacturers and axle makers, and they insisted they must have, at least, as much of the axle as we were giving them. It has been rather an accepted standard that the length of the wheel fit should not be less than the diameter, but I do not know that this point has ever been worked out. In fact, the wheel makers assure us there is absolutely no question but that a wheel can be fitted to the larger diameter axles and be absolutely safe, and we have the same assurance from the cast wheel makers for the smaller axles. The opinion of the committee was that for the present at least the steel wheels would be used on the larger diameters. In reply to what has been said about the keyway, the committee has not recommended that a keyway is always necessary, in fact I might say that I think I voice the sentiment of the majority of the committee that the keyway is not necessary, but we deem it advisable since a great many roads are using the keyways to give the dimensions which we consider are the very best practice. To Mr. Ayres and also to Mr. Sergeant, I want to say that we found that our recommendations in general very nearly coincide with the standards as adopted by many of the largest systems of the country, and it was very gratifying to the committee to know that in comparing these recommendations with what has been the general shop practice for many of the larger manufacturers, we find that they almost exactly correspond. Consequently, the axle which we recommend is not an experiment. The point that Mr. Ayres raises in regard to the wheel fit not being larger where it enters the wheel is one which was exploded some years ago, and it is necessary that the axle at that point be much larger as that is where the stresses and strains all concentrate, whether it is a motor axle or simply a carrying axle.

Mr. Storer:—Mr. Connette, I think, raised the point whether it was good practice to have a longer wheel fit on the small axles than on the large ones. I think that can be overcome by releasing a couple of inches more of the small axles for the motor builder

President Adams:—That is the spirit which we found the motor builders expressed right through all the discussion.

If there is no further discussion on the question of axles we will proceed to the discussion of the journals and journal bearings.

Mr. Priest:—I want to call attention to one point in reference to axles. In general I favor the report of the committee but would suggest that it is desirable to specify whether the gear manufacturer or axle manufacturer should allow for the shrinking or pressing fit of gears. It is a small point but an important one to know so that we can have a standard to follow. As it is now, sometimes the axle manufacturer allows for the pressing fit, and at other times the gear manufacturer. It should be definitely stated whether the gear manufacturer or the axle manufacturer should provide for the fit.

Mr. Dickey:—The usual practice is to turn the axle to the actual diameter and bore the gear and wheel smaller to allow for pressing on. It is most convenient for the manufacturer to have it done in this way.

Mr. Adams:—One reason why the gear manufacturers should allow variation in bore for tonnage is they know the kind of material in their gears and can allow greater or lesser variation according to the hardness of the metal. Under the circumstances, I think the gear seat on the axle should be turned to the standard size.

Mr. Evans:—I do not think, Mr. Priest, there is room for any discussion on that point, as we specify the dimension of the axle and it will be necessary for the wheel maker or the gear maker, to bore his gear a sufficient number of thousandths of an inch smaller so as to press on the axle as we have specified. I do not think there is any question about it. If we turn up an axle to our dimensions we will have to have the wheel to press on at the required tonnage.

Mr. Priest:—This point has been called to my attention a number of times and that is the reason for speaking of it now. I do not criticise the practice of making the allowance in the gear bore. It should however be definitely understood that the gear manufacturer will make the allowance.

Mr. Estep:—In regard to our gear practice, when a gear is ordered to be of a certain diameter, it means so much allowance for pressing or fitting. In answer to the remark made by Mr. Ayres in regard to the fit of the gear, I would say that in cases where the axle has the same diameter at the gear fit that it has at the wheel fit, it has been demonstrated to us fully that when the gear reaches the gear seat it has lost the amount of pressure necessary to put it on in the first place. Our recommendations are to reduce the wheel fit so that you will pass over it without pressure.

President Adams:—We will now proceed to the discussion of journals and journal boxes.

Mr. Evans:—The question of journals is properly taken care of in the diameter of axles recommended. The journal box recommendations very nearly correspond to what has been the practice and in so far as these dimensions are recommended, we have used those which have been employed in axles of this capacity.

President Adams:—We would like to hear from Mr. Weston.

Mr. Weston:—I believe this association in adopting the journal box standards as recommended by the committee will confer a greater benefit on the traction companies than on the journal box manufacturers. One of the most discouraging things to the journal box manufacturer up to the present time has been the great variety of patterns he has had to carry to supply the traction company's needs, with the result that the car and truck builders in receiving orders for repair parts get perhaps more profit than they should receive. I do not believe it will be imposing any greater hardship on the truck builders and car builders to design their trucks to suit a standard journal box than to suit a standard axle.

President Adams:—This is a subject that seems to have been very well covered by the committee, and it has given the various sized journal boxes for the various journals as recommended, and I do not know that there is much discussion that would be necessary upon this particular recommendation.

If there is no further discussion upon the question of journals and journal boxes we will proceed to the next topic which is an exceedingly important one to us all, the brake shoes and shoe heads. The committee has recommended here shoes and shoe heads that will fit the requirements of most every road in the country, whether they are using a wide tread wheel or a narrow tread wheel, and they have put forth a recommendation that will save the roads of this country a tremendous amount of money. We will be glad to hear from anyone who has anything to say on this subject. Is Mr. Sargent of the American Brake Shoe & Foundry Co. here?

MR. EVANS:— I will say for Mr. Sargent and the representatives of the brake shoe manufacturers that the recommendation seems to meet with their entire approval, as they have experienced the same trouble mentioned by Mr. Weston in regard to journal boxes, and are vary anxious indeed to get the number of patterns reduced as much as possible; and, while they do not commit themselves to say so — and I do not know that I should say it for them — they do intimate that it will be commercially a great advantage to have a standard pattern of brake shoe. In this connection I want to say that the brake shoe which we have recommended, the A shoe, is adaptable to use on any steam road equipment that any of the properties may be operating in connection with the one we use — it is interchangeable with the regular steam road pattern, but the narrow shoe is simply recommended to take care of the narrow wheels that are in service.

PRESIDENT ADAMS:— There seems to be no further discussion on this question of brake shoes and brake heads, we will therefore proceed to the next topic, which is Topic C, "Standard Section of Tread and Flange of Wheel."

MR. VOYNOW:— On page 152 it is stated that a wide tread, etc., avoids the necessity for flange bearing on special work. I don't see how it would change the condition in a right angle crossing. I would like to have an explanation.

Mr. Clark:—All the rest of us do not live in Philadelphia. They have nothing but right angled crossings in Philadelphia.

Mr. Voynow:—The statement should then be modified to read "some special work" instead of "all special work."

Mr. Ayres:—I am inclined to say that we ought to have one more style of wheel than is shown here, one with a 2.5-in. tread and a ⅞-in. flange. As a matter of fact, on our road we are using that wheel now, and in our effort to come to a standard we wouldn't like to have to use a shorter flange if we had to continue the narrow tread. It seems to me it would be a good idea to provide an additional standard for cases in which it is possible to use the deeper flange, but not the wide tread.

Mr. Evans:—Mr. Chairman, in regard to the question of the ⅞-in. flange and the 2.5-in. tread, I would say if the gentleman is using a 2.5-in. tread, with a ⅞-in. flange, there is no reason why he cannot use 3-in. tread with ⅞-in. flange. He may possibly be inclined to contradict me, but as evidence of my contention I would state that we have put into service a 3-in. tread and ⅞-in. flange, where it was previously thought almost impossible to operate a wheel tread as wide as 3 inches; and if the conditions are such as will permit of a flange ⅞-in. in depth, I certainly wouldn't advise the use of the 2.5-in. tread.

In this connection, as the report states, Mr. President, I think there has been a prevailing tendency to use a much narrower tread than that required by the increased weight of the cars in city service; and if you visit any city that employs the very narrow tread, you will see, almost without exception, a wonderfully bad state of special work. Moreover, in that particular, the wear of the special work is self-evident. But, Mr. President, it is very difficult to estimate the damage that such special work does to the equipment in the way of broken axles and broken motors, wrecked frames and everything else in connection with the equipment, and, Mr. Ayers, that is the reason why the committee favors the employment of a wider tread wheel. In connection with what the gentleman has said in regard to the 3.5-in. tread, I would say that the representatives of the special work have found that a 3.5-in. tread would very materially assist, in fact, avoid the necessity for the use of floors in the special work, except possibly in Philadelphia, where they have all square crossings according to Mr. Clark.

Mr. Ayres:— I am thoroughly of the opinion that a wider tread is desirable, and I would much rather use the 3.5-in. than the 3-in.; but you will readily understand that where it is necessary to run, as we do, the same cars over the lines of three different companies, and in nine different municipalities, it is pretty hard work to do just what we think ought to be done. I hope we shall be able to use the standard given here, with the 3.5-in. tread, some time.

Mr. Simmons:— In that connection I would like to say I take it that that is for the purpose of the Standardization report. There will be lots of conditions similar to Mr. Ayres' where probably for a long time it will be impossible to increase the width of the tread or the depth of the flange, or to entirely change the special work so as to avoid the carrying of the load on the flanges; but if we adopt a standard which is simply held up as an ultimate goal, we will all work toward it. Mr. Ayres' company among the rest.

Mr. Allen:— Has the committee given the question of safety its fullest consideration in recommending the 3-in. tread wheels for interurban service? It would seem that the 3-in. tread for interurban service is not quite as wide a tread as is necessary.

I would like to have the committee explain this further.

Mr. Evans:— I would say, Mr. Allen, that we have recommended 3.5-in. for interurban service; but as some interurban cars operate where they cannot have 3.5-in., we consider 3-in. sufficient under those circumstances. As I stated before, where it is possible, and steam road conditions prevail, the committee rather took it for granted that the regular Master Car Builders' section would be employed, and we did not consider that it was necessary to have intermediate sections between what we are recommending and the Master Car Builders' standard.

Mr. Olds:— Regarding the size of the wheel tread and flange, I would say: When we started out years ago in Milwaukee we had a flange that was ⅝-in. deep by 0.75-in. in thickness. We have increased it so that it is practically the same as recommended for your city wheels. It would be impossible for us to use very much deeper flanges until our old special work and rail is removed from the street. Our new wheels are made with a 13/16-in. by 1⅛-in. flange. Were it possible for us to use a deeper flange than ⅞-in. as recommended, or a wider tread, I would recommend the MCB standard as that is really the goal that we should be aiming at. It is one that will be attained in the not very distant future. Our interurban cars are using at the present time wheels with 2.75-in. tread. It is not as wide as I would like. We started out with 1.75-in. tread on our city cars but have grown a little, year by year, and at the present time have a 2.5-in. tread. I think by the time another year rolls around, we will be able to state that our city cars will be using 2.75-in. and the interurban 3-in.

MR. WELSH :— We have used a 3-in. tread on all trucks that have frames wide enough to receive a wheel with 3-in. tread. We have obtained between 15,000 and 20,000 miles per wheel more than with the 2.5-in. tread, besides protecting our special work. We use a 525-lb. double plate wheel.

MR. LINCOLN :— We have heard the report read, and the comments on it; and I would make this motion, that the report be accepted and adopted by this association.

MR. SMITH :— I second that motion.

PRESIDENT ADAMS :— I desire to make a suggestion regarding that motion. The report is to be presented by this association to the American Street and Interurban Railway Association for its approval, and if I can offer this procedure as a suggestion to be embodied in the motion, I think it will be desirable.

MR. SMITH :— I second the remarks of the president on that motion.

MR. ROBERTS :— Before putting that motion, I would like to mention one matter that has not been noticed. We are using 3-in. tread for interurban work and we have the consideration before us, so far as the cities are concerned, a very troublesome one too — that is about the pavement. For the city service we are using a 2.75-in. tread, and the tendency now is to confine the tread of wheels to 2.75 inches. It is impossible to get a tread with a 0.75-in. flange wider than 2.75 inches into place in a Brill 27 F I truck. A little while ago I was expecting to be compelled to use some city wheels, but what we have been using were 2⅞-in. tread and I had to face them down to 2.75 inches. I think there might be a step made there in advance of any proceeding being taken and a suggestion made to the Brill Company — of course we all know that large bodies move slowly — but the suggestion might be made that they make some arrangement so that the wheels can be gotten in the trucks after you have decided to adopt the 3-in. tread for city service.

President Adams:— The Brill Company has had a representative at every meeting of this committee, and it appreciates the point that you bring out, fully, and that matter has been thoroughly considered by the committee, and this, as stated on several occasions is their recommended best practice. Now, gentlemen, we have a motion before the house, the consideration of which is in order. Is there any discussion upon this motion that Mr. Lincoln has made that this report be accepted, adopted and recommended to the American Street and Interurban Railway Association for its approval? (Motion carried unanimously.)

President Adams:— Gentlemen, I want to thank you for backing up the work of this committe in that manner. Its members certainly deserve it, and I believe there will be no question about the approval of the American Association.

The chairman of this committee has just informed me that he would like to say a word, and he is entitled to that word.

Mr. Evans:— It is indeed very gratifying to the committee to have the action taken which you have just passed. It is pleasing to note the interest taken this afternoon; but the one point that I arose to make, Mr. Chairman, is that we can adopt resolutions and make drawings and talk standards until we are black in the face, but little will be accomplished if we don't go home and put them into practical use. The committee feels that these are thoroughly practical recommendations, and we hope that the American Street and Interurban Railway Association at their session will authorize the the adoption of them as standards. We hope that they will also favor this report, as it has a great many recommendations which have not been touched on this afternoon.

President Adams:— I can back up the expressions that Mr. Evans has just made in that connection. It is up to every one of us and to the heads of the roads in this country to adopt these recommendations and put them into practice. Then we will have something as the result of this work. If we are just going to pigeonhole this report, why there is no result accomplished; but I don't think it is going into the pigeonhole.

Mr. Lincoln:— Isn't that Standardization Committee to receive the usual vote of thanks and so on?

President Adams:— A motion will be in order, sir.

Mr. Smith:— I move that the committee be extended two votes of thanks.

President Adams:— Gentlemen, there is a motion before the house that a vote of thanks be extended to this committee, and I call for a rising vote on that question. (Motion unanimously carried.)

Mr. Evans:— For the committee I desire to thank the association for this expression of its appreciation.

President Adams:— Gentlemen, the next order of business is the report of the Committee on Open versus Closed Terminals for Car Houses. Mr. Schreiber will kindly present this report for the committee.

## REPORT OF THE COMMITTEE ON OPEN VERSUS CLOSED TERMINALS FOR CAR HOUSES.

Your committee on Open versus Closed Terminals begs to submit the following report:

On investigation of the points at issue in the proposed discussion, it appears that there has been some misinterpretation of our subject.

It can be established beyond all reasonable doubt that there is no question about open or closed storage for cars that are not in operation or out of season equipment. It is certain that a car standing idle will depreciate faster in the open than it would if placed under cover, let this cover be a building, canvas or any other protection. Besides, a greater expenditure for maintenance would be required than what is represented in the saving of the first cost of the cover, plus the maintenance of a protected car. So we are presuming that our subject evolves itself into a discussion as to whether or not it is economical and desirable to operate cars out of an entirely closed depot, or out of a terminal that only has a shelter for offices, men's quarters, inspection shed, etc., and with the trackage in general or in part unprotected.

Then the subject before us deals with live cars and rolling equipment in service. As soon as a car is not fit for the road for any length of time, it is to be taken off the premises and put into permanent protected storage or shop. Again open terminal operation would not be a fair question in climates subject to severe weather conditions, say, where there were long, rainy seasons, or much snowfall. Then an open terminal would have an advantage where a considerable percentage of the rolling equipment was changed each season. Take the case of summer and winter cars, where summer cars are used four or five months and closed cars the remainder of the time. Here the equipment is out of service and placed in a regular storage barn; so, in this case, a car is protected a considerable portion of its existence, let it be or not be operated from an open yard.

If a railroad company is not able to obtain a large amount of money at one time, an open terminal would seem to have a considerable advantage and be worthy of important consideration. Then the existing conditions are liable to vary on account of consolidation of lines or other causes; and in this modern day of different ideas of different organizations, there is often a question about permanent location, so here we have another point commendable for the small investment.

In order to make the discussion clear and intelligible, several layouts are submitted which approach very closely to actual practical examples of car barn operation now being carried out on some of the large properties.

Referring to Fig. 1, we have a closed operating depot. The general construction is pretty well illustrated in the figure. There are twelve tracks under cover and one track outside. The offices, men's quarters, lockers, toilet rooms, etc., are on the second floor at the front of the structure, while at the west side are provisions for starter, another toilet and bins for sand, coal, salt, coke, a compartment for oil and lamps and a storeroom.

The special work is arranged, so that cars may enter the building by the front and leave by the rear. There is a pit 150 feet long under each track, so that a car entering the barn must necessarily pass over it before being permanently placed. All the floors are 5-in. concrete, cement finish on a sub-base of 12 inches of ashes.

The walls of the building are of brick, 12 inches thick, with 24 by 20-in. pilasters on 16-ft. centers, and there are four bays, each containing three tracks, so that the fire risk will not be excessive in any one compartment. There is a clear space of 16 feet under trusses and

the roof is of heavy mill construction with wire glass skylights and galvanized iron ventilators. Trolley wire is protected by troughing and light wire is enclosed in metal conduit approved by the underwriters. There are ample provisions for other fire protective apparatus; outside fire hydrants, inside fire hydrants, chemical fire extinguishers, fire pails, auxiliary fire alarm and a sprinkling system.

It is understood that the committee does not submit the details of the depots as a criterion or standard type, but is presenting the layouts as representing permanent modern construction, with all necessary requirements; but at the same time of economical design. It is evident that the cost per square foot will be low as compared with some of our present structures that represent operating depots. Many are long spans, high roofed and elaborate in detail, that would often mean an increase of fifty per cent. over the figures that we are about to designate. It is noted that the cost of a sprinkling system is included in the terminals, but in using figures for open terminals against closed terminals, no advantage is taken of the cost of the sprinkling equipment. But it appears that in using an open yard for operating, it would not be very practical to install a sprinkling system, but fire hydrants, chemical fire extinguishers, water pails and an auxiliary fire alarm system could be used.

Now the same barn illustrated by Fig. 1 may be considered an open operating terminal by simply cutting a portion of the building as designed by line A. B. on drawing. Then we would have offices, men's quarters, etc., still intact and protection for 100 feet of pits so that repairs and inspections could be comfortably carried on. Similarly any portion of the operating barn outside of line A. B. may be taken away.

Fig. 2 is intended to show another layout but somewhat on a different plan. In this example the offices, men's quarters, inspecting shed, etc., are separate from the barn proper and do not represent a minimum space design, but have the advantage of convenience. Here it is taken that the barn is located at the end of the division and also is the turning point for cars when in service. We also have pits 150 feet long as previously figured but, in addition, there is an inspection shed with a pit that is protected. So that each trip a car makes in going around the loop, it must pass through the inspection shed and over the pit, where it is examined and inspected by the regular housemen. Again the major portion of the repair work is done in the day time, and night repairing, when cars are supposed to be in storage and out of service, is reduced to a minimum. Considering the layout as a closed terminal, we have four tracks in each bay, and the walls are of brick and the roof made up of steel trusses arranged with monitors and skylights the entire length. Here we also have 16 feet under trusses and a concrete floor. Separate buildings are of a substantial brick design and of one story construction. The fire protection for the entire design would follow on similar lines to those described in the first figure.

Fig. 2 may be considered an open terminal by retaining the office building, inspection shed and pits. The cars in the yard under such an arrangement would have no protection. Again any portion of the barn proper may be retained.

Fig. 3 shows still another form of an open car barn terminal, where the scheme of Figs. 1 and 2 are consolidated. Like Fig. 2 the office building is a separate structure, but similar to Fig. 1, part of the trackage is protected for inspections and repairs. However, in this layout we have a terminal that would take care of 50 cars, while in the others suggested 84 cars would be operated. Besides, the design only allows cars to enter from one end of the property, and if single-end equipment was operated the cars would be required to back in or out of the property; so double-end operation would be more favorable. In this layout it is noted that provision is made for proposed closed barn sometime in the future. It seems it would be good practice in building an open operating terminal under any conditions to allow for converting it into a closed terminal if, in the future, it might be considered advisable.

Below is an estimate of the cost of the different depots that have been referred to above. In the estimate submitted only the price of the building has been considered, for it is understood that the track layout, when we are comparing open and closed operating depots at the same location, is practically equal, so that the question of trackage does not enter into the discussion:

| | |
|---|---|
| Fig. 1, closed terminal | $105,000 |
| (plus $14,000 sprinkling system) | |
| Open terminal cut off at line A. B | 45,000 |
| Difference | $60,000 |
| Fig. 2, closed terminal | $108,000 |
| (plus $14,000 sprinkling system) | |
| Open terminal trackage unprotected | 25,000 |
| Difference | $83,000 |
| Fig. 3, closed terminal | $108,000 |
| (plus $14,000 sprinkling system) | |
| Open terminal, offices remain and 100 feet of barn | 49,000 |
| Difference | $59,000 |

Referring to Fig. 1, open car barn layout, a saving is shown in the first cost of $60,000 over the closed barn; and figuring five per cent. on investment and seven per cent. on insurance, taxes, maintenance and depreciation, we have a total of twelve per cent., which represents an annual saving of $7,200. Of course there may be further variations in the saving by simply changing the area of the protected section of car barn; in other words, when we increase the building covering a portion of the tracks, the annual saving decreases and when it becomes nothing we have a closed barn.

Fig. 2, open car barn layout, shows a saving in the first cost of $83,000 and $59,000 respectively, and an annual saving of $9,960 and $7,080.

From the above it is plain that there is good reason for considering an open operating terminal. To take a concrete example, and as afterward will be explained, it is not held that the particular property or condition designated generally applies, but it is necessary to know what are the conditions to which the property is subjected, in order to come to any decision for or against an open or closed operating barn. In the layout in Fig. 1, figuring the length of a car to be 50 feet, including clearance, the barn would accommodate 84 cars; assuming that two-thirds of the cars are regulars running from six o'clock in the morning to twelve at night, and one-third are trippers that are on the road six hours out of the twenty-four, and all the cars are in the house from twelve at night until six in the morning, then we have the following figures:

| | | |
|---|---|---|
| Total hours possible with the equipment | 84 by 24 = | 2,016 |
| Regulars | 56 by 18 = | 1,008 |
| Trippers | 28 by 6 = | 168 |
| Total | | 1,176 |

against a possible 2,016, so we have about 50 per cent. of the equipment out of the barn all the time. The terminal designated when considered as an open barn, cut off on line A. B., is designed to protect about one-third of the equipment. In other words, all cars standing in the barn from six o'clock in the morning until 12 o'clock at night, are protected, and different cars could be housed on different days. Certainly those that were disabled would naturally be the ones retained in the barn, so it appears the principal advantage of a closed terminal in this particular instance is the fact that from 12 o'clock at night until 6 o'clock in the morning, two-thirds more cars are under cover, which is not the case with the open arrangement. This means besides the first cost of investment of $60,000, it is worth $85 per car per year for every car that is being operated in order to accomplish the result. Figuring that it costs $400 to maintain a car for a year and the entire maintenance for body, painting and varnishing is twenty-five per cent. we would have $100 for these items, which makes it appear favorable for the open yard. In Fig. 2, we do not have the advantage of protecting one-third of the equipment between rush hours but on the other hand the difference for an open terminal would be $83,000 and $59,000, first cost of investment and $118 and $84 per car per annum. A master mechanic of a very large road made the statement that the life of the paint is 50 per cent. less for open yard operation than for closed operation, and the maintenance for modern electric equipment is the same, while the deterioration of bodies and woodwork is not over 30 per cent. in favor of a housed car.

On the other hand, there are considerations backed by important advantages for tracks that are entirely protected and those advantages go a considerable way in neutralizing the saving we have designated. The bad feature about a car being outside all the time is that the joints in the woodwork do not have an opportunity to dry out, causing a rapid deterioration. Panels become wet and spongy all the way through and their life is shortened, as well as that of the roof. When the rolling equipment is entirely protected by a cover there is ease of inspection, and this has more significance than its literal meaning, because in severe weather it is unfavorable for workmen, who will not do as well when they are forced to work in discomfort and exposure. Experience has proven that attention and proper repairs to cars in the open are neglected, and that this method encourages carelessness by housemen. Naturally the little necessities will be let go for another time, which is sure to have a serious effect on the economical maintenance of the equipment and increasing depreciation. In fact it is very difficult for any one to anticipate how much open inspection or storage of cars does affect the entire cost of maintenance, on account of the reasons referred to. It is not only the direct results of the paint, varnish, woodwork and wiring that is affected, but how much does the rest of the equipment suffer? Of course this argument is very materially reduced when cars are taken care of in an open barn, as in Fig. 2, and where they are inspected every trip. There is no doubt that considerable inconvenience as well as cost is caused by open terminal operation during severe weather. Brakes are set when a car is run in and the motors are more or less heated; then snow drifts in so that as soon as the equipment cools off sufficiently to freeze, the brake shoes hold fast to the wheel. It is also necessary to send out the cars in severe weather on the road without being cleaned, which is more or less unsatisfactory.

Another consideration for the closed terminal is the increase in the number of extras that are run on most systems, especially in large cities. With many companies practically the same number of extras are handled as regulars. This increases the number of cars to keep in storage between rush hours. Then, when the terminal is large, there is the advantage of dividing it into separate compartments for better fire protection.

Summing up the situation it is positive that a marked saving could be made if the conditions on the particular property were favorable, by using an open layout. But the committee is not prepared to make a general statement recommending either open or closed terminals, without first knowing the conditions that exist on the particular property. However, below are seven questions and answers, which would seem to make it a comparatively simple matter to decide for or against an open or closed terminal:

QUESTIONS:

(1) Climate?
(2) Finance?
(3) Do you anticipate any change in desired location?
(4) Are the same cars operated the entire year? Or do you have an open and closed car barn equipment with permanent storage for out of service cars?
(5) What proportion of the 24 hours are all of your cars housed? What proportion of cars are in barn between rush hours?
(6) Do you intend storing out of season or out of service cars at operating terminals? Or do you have other locations for permanent storage?
(7) Is most of the repairing and inspection of rolling equipment done in the day time or at night? And will barn be located so that an arrangement would be desirable as shown in Fig. 2?

CONCLUSIONS:

(1) Mild and comfortable climates would be favorable to unprotected yards. Extreme weather would make closed terminals desirable.
(2) Inability of management to get large sums of money for investment would favor an open terminal.
(3) Anticipated change in location would want an open terminal.
(4) A large proportion of cars when out of season stored in separate storage barns leans toward unprotected terminals.
(5) The more cars housed and the less on the road the entire 24 hours favors protected trackage.
(6) If the terminal is used for storing out of service cars as well as actual operating rolling equipment it makes protected depots a necessity.
(7) If terminal is located at lay-over point or end of trips for all cars, so that they may be inspected at turning points and no repairs are made at night, this would be a point in favor of an open operating barn.

Respectfully submitted,

EDWIN W. OLDS, *Chairman.*
JOHN HANF,
MARTIN SCHREIBER,

*Committee on Open versus Closed Terminals for Car Houses.*

MR. SCHREIBER:— The thought has come to us since we submitted this report that still another design might be considered that has never been tried, and that is to take a car barn layout with one-third of the cars covered and protection for offices and men's quarters, and for the remainder of barn to build a sort of a cheap umbrella-type of protection. The details of this I am not just ready to describe, but am confident that it could be satisfactorily worked out. However, you are still against the same proposition if you have a very large barn, of separating it into compartments for fire protection.

PRESIDENT ADAMS:— Gentlemen, you have heard this very able report which Mr. Schreiber has read on behalf of the committee, and I want to have the same thrown open for discussion, but before doing so I am going to ask Mr. Simmons to take the chair, as I have to leave to attend an executive committee meeting of the American Association.

First Vice-President Simmons in the chair.)

VICE-PRESIDENT SIMMONS:— Gentlemen, you have heard this report read, and we would be very glad to develop a little discussion of it. I think some expression of opinion, or of experiences with one or the other type of construction, would be enlightening to the association and probably of advantage in any future or more definite work that might be carried forward.

### *Discussion of the Report of the Committee on Open Versus Closed Terminals for Car Storage.*

MR. ROBERTS:— Mr. Chairman. I think the fact that the gentlemen remain silent is a compliment to the committee which has prepared this report. I think the ground has been fully covered. I know that in the spring of this year we asked for two rather large appropriations for putting in new shops and car houses, but on mature consideration we deferred action until this report could be considered. Now, I am not altogether sorry that these appropriations were not granted, because I have learned very much from this report. I think the report of the committee has very clearly shown that the practice of building extensive shops for complete housing of cars is scarcely worth while. I will be largely guided in my future recommendations by the plan mapped out here by the committee which made this report. I, for one, feel personally very grateful to it for this work, because I am sure a great forward step has been taken, so far as this part of our work is concerned. I don't know whether the members will take it as a compliment, but so far as I am concerned I will make my future recommendations based on this report.

Vice-President Simmons:— I am sure Mr. Roberts' remarks will be very gratifying to the committee, and even if there is no one who desires to discuss the report any further, just such gratifying statements as that will be appreciated by the committee.

Mr. Harvie:— In regard to the matter of shops, we are now building some new shops in Syracuse. I understand, however, this arrangement mentioned applies particularly to car houses or storage yards. I can only say that our experience in Utica has been that varnish deteriorates very rapidly in our climate in open storage, but in the city of Syracuse we have just finished a storage yard of quite good size (19 tracks) for open storage. I expect to watch the results with a good deal of interest.

Vice-President Simmons:— If there is no further discussion of this paper we will proceed to the next order of business on the program, which is a report of the Committee on Operating and Storage Car House Designs. Mr. Bushnell was in charge of this committee, but it has not been able to prepare anything definite for presentation to the association. This matter will therefore have to be passed.

The next order of business, and the final one for this afternoon, is the Question Box, which has been worked out in a very complete manner by our secretary. He has requested me to carry the matter forward, and you will note that there have been 61 questions included in this Question Box and there have been a very large number of answers to some of the questions, and some answers to all of them. It would consume too much time to endeavor to go through all the questions.

# QUESTION BOX.

## Power Houses.

### Question 1.

*Is the use of jet condensers on turbine installation advisable?*

### ANSWERS.

No. Better vacuum with surface and use condensed water in boilers.
—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. Dyer, Jr., *Assistant General Manager.*

Have found the use of jet condensers on turbines advisable from several standpoints. Decreased cost over surface condensers. No tubes to become leaky and split. Ability to carry as high a vacuum as with a surface condenser, with decreased maintenance. If injection water is not salt, it can be used for boiler feed, its temperature being as high as the hot well water of the surface condenser.
—*Lynchburg Traction & Light Co., Lynchburg, Va.,* A. J. Kohler, *Chief Engineer.*

The use of jet condensers on turbine installation is not advisable. Surface condensers work successfully and give better satisfaction.
—*Little Rock Railway & Electric Co., Little Rock, Ark.,* D. A. Hegarty, *Treasurer and General Manager.*

Jet condensers have been installed in many of the later turbine installations.
—*Electric Traction Weekly, Cleveland, O.,* C. B. Fairchild, Jr., Editor.

In some cases.
—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

The use of surface condensers in connection with the steam turbine is an ideal condition if the condenser can be kept tight. The absence of all oils in the water of condensation makes it an excellent boiler feed water. Surface condensers around the city of New York have not, as a rule, been a very great success. In only a very few places has it been possible to use water of condensation. The cost of labor and material necessary to keep the condenser tight more than offsets the saving that would be made by the use of the water of condensation. The economy of the steam turbine is more susceptible to vacuum than that of the reciprocating engine. The fraction of an inch reduction in the vacuum means a considerable increase in the pounds of water per h.p-hour. The principal cause of leaky condensers is pitting. A number of means for preventing this have been tried, but no one has been wholly successful. In some of the large power stations boosters are used and in nearly all power stations different kinds and mixtures of metals have been employed but without success. Where water is not very expensive I would advocate the installation of a jet condenser, but where water is as expensive as $1.00 per thousand cubic feet I would recommend the installation of surface condensers and entertain the hope that a remedy for the trouble experienced with them will be found before very long.

—ALFRED GREEN, 111 *Columbia Heights, Brooklyn, N. Y.*

No.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

The use of jet condensers on a turbine installation depends on the volume of water available for the condenser. If the question of the boiler feed water and particularly the water for the condensers is important, the surface condenser is by far the better; otherwise the jet condenser would be just as satisfactory and much cheaper.

—*Knoxville Railway & Light Co., Knoxville, Tenn.,* P. E. MITCHEL, *General Superintendent.*

Yes, simplicity is warranted where it is not advantageous to use the water over again.

—*Public Service Corporation of New Jersey, Newark, N. J.,* R. E. DANFORTH, *General Manager.*

A barometric condenser, defined as a jet condenser with an air pump attached, is the best form of condenser to run with turbines, as a high and very steady vacuum may be obtained.

—*Toronto Railway Co., Toronto, Ont.,* WM. B. BOND, *Chief Electrician.*

## Question 2.

*Have you had any trouble with stripping of blades in a turbine of either the Parsons or Curtis type? If so, to what did you lay the cause? What do you suggest as a remedy?*

### ANSWERS.

No trouble. Operating fifteen months.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. DYER, JR., *Assistant General Manager.*

Have had no trouble from stripping of blades. Our turbines are of the Curtis type.

—*Little Rock Railway & Electric Co., Little Rock, Ark.,* D. A. HEGARTY, *Treasurer and General Manager.*

We have partly stripped the blades from two 2,250-h.p. Parsons turbines. Cause, exceptionally long spindle, flexibility, distortion, and an imperfect balance. Remedied with a shorter spindle.

—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

Have run two 500-kw. Curtis turbines 30 months and have had no trouble with the blades.

—*Rockland, Thomaston & Camden Street Railway Co., Rockland, Me.,* THOS. HAWKENS, *General Manager.*

No trouble so far.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

Never stripped a blade.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Never. Curtis used.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

We have had blades stripped from the Curtis turbine, caused by failure of the step bearing.

—*Knoxville Railway & Light Co., Knoxville, Tenn.,* P. E. MITCHEL, *General Superintendent.*

No.

—*Public Service Corporation of New Jersey, Newark, N. J.,* R. E. DANFORTH, *General Manager.*

I have never had very much experience in the operation of turbines, but I can say in general that there should not be trouble with stripping of blades in normal operation. The Curtis turbine is supposed to have enough clearance so that if the oil leaks out of the oil bearings the thrust blocks will come together before the blades strip. The horizontal turbines, of course, should not be liable to stripping of blades and are not unless careless operation permits too much play.

—*Toronto Railway Co., Toronto, Ont.,* WM. B. BOND, *Chief Electrician.*

## Question 3.

*Have you had any trouble caused by deposits of foreign matter forming on the blades of the turbine? How do you remedy this?*

### ANSWERS.

No. Use condensed water for scaling glands.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. DYER, JR., *Assistant General Manager.*

Have had no trouble caused by deposit of foreign matter.

—*Little Rock Railway & Electric Co., Little Rock, Ark.,* D. A. Hegarty, *Treasurer and General Manager.*

We have had no trouble by deposit of foreign matter on the blades of the turbine. Have had considerable deposit due to gland water, in the gland and on the ends of the spindle. Remedy: A cistern with treated or soft water in connection with a cooling tower.

—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

None whatever.

—*Rockland, Thomaston & Camden Street Railway Co., Rockland, Me.,* Thos. Hawkens, *General Manager.*

No.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

Steam as dry as possible should be used and care should be taken to see that the proper kind and amount of boiler compound is used. With the superheated steam there should be practically no deposit on the blades or vanes of the turbine. Leaky condensers causing the percentage of salt in the boiler feed water to be high may be responsible for some of the deposit that has been found in turbines.

—Alfred Green, 111 *Columbia Heights, Brooklyn, N. Y.*

No.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

Yes, in some instances now being investigated. Have heard of a case where such a deposit was due to boiler compound.

—*Public Service Corporation of New Jersey, Newark, N. J.,* R. E. Danforth, *General Manager.*

I have never heard of any trouble from this cause with any form of turbines. It is my opinion that any scale forming matter would be likely to be deposited in the boilers, rather than carried in by the steam.

—*Toronto Railway Co., Toronto, Ont.,* Wm. B. Bond, *Chief Electrician.*

## Question 4.

*What success have you had with motor generators wound for 6,600 to 16,000 volts on the a. c. side? Is any difficulty experienced due to direct exposure of windings to lightning?*

### ANSWERS.

We have operated 13,200-volt generators for four years and have had no breakdown or disturbance from lightning.

—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

No experience.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

With a proper lightning arrester I think no great difficulty need be experienced with motor generators wound for 6,000 to 16,000 volts on the a. c. side.

—Alfred Green, 111 *Columbia Heights, Brooklyn, N. Y.*

Have had no trouble. The high tension is turbine-driven.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

The lower voltage which you mention, namely 6,600 volts, I should say is about the limit for good practice in the direct operation of motors; 16,000 volts is, in my opinion, very much too high. I presume it could go to 10,000 volts, but I think it would be very much better to keep the voltage lower. The risk of trouble with lightning is certainly much greater with the line voltage impressed directly upon the motors than if it impressed directly upon transformers, for transformers generally are much more easily repaired than motors, in case of damage from lighting.

—*Toronto Railway Co., Toronto, Ont.,* Wm. B. Bond, *Chief Electrician.*

## Question 5.

*What is the smallest size of boiler plant, or the minimum coal consumption that would warrant the use of automatic stokers?*

### ANSWERS.

Depends on cost and kind of coal used.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. Dyer, Jr., *Assistant General Manager.*

A plant consuming thirty tons of coal in eighteen hours, developing its rated boiler h.p., should be equipped with stokers.

—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

About 2,000 h.p. with one boiler in reserve for hand firing for peaks.

—*The Calumet Electric Street Railway Co., Chicago, Ill.,* H. M. Sloan, *General Manager.*

1,200 h.p.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

It would depend on a number of conditions, such as the cost of labor; cost and kind of coal burned.

—Alfred Green, 111 *Columbia Heights, Brooklyn, N. Y.*

My choice is 1,000 h.p. but a Caldwell shovel is economy on a single boiler.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

Six boilers.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

Would say that the smallest boiler plant on which automatic stokers would pay, would be in the neighborhood of 4,000 h.p.

—*Knoxville Railway & Light Co., Knoxville, Tenn.,* P. E. Mitchel, *General Superintendent.*

This depends largely upon local labor and fuel conditions, but I should say that a 1,000 h.p. plant would justify stokers in any locality and that smokeless boiler operation and good boiler efficiency would justify automatic stokers down to 500 h.p.

—*Toronto Railway Co., Toronto, Ont.,* Wm. B. Bond, *Chief Electrician.*

## Question 6.

*Is it advisable to use gaskets for superheated steam headers?*

### ANSWERS.

It is better to use ground joints for superheated steam headers.

—*Little Rock Railway & Electric Co., Little Rock, Ark.,* D. A. Hegarty, *Treasurer and General Manager.*

Yes.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

The ground joint I think is preferable to a gasket on a superheated steam header.

—Alfred Green, 111 *Columbia Heights, Brooklyn, N. Y.*

No.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

Yes.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

Would advise corrugated copper gaskets on superheated steam headers.

—*Knoxville Railway & Light Co., Knoxville, Tenn.,* P. E. MITCHEL, *General Superintendent.*

Yes.

—*Public Service Corporation of New Jersey, Newark, N. J.,* R. E. DANFORTH, *General Manager.*

Mechanical engineers agree that the best modern practices require ground joints without gaskets for high pressure steam fittings, but I believe they also agree that this practice is extremely difficult to obtain. I think some form of copper or asbestos gasket is used in almost every case.

—*Toronto Railway Co., Toronto, Ont.,* WM. B. BOND, *Chief Electrician.*

## Question 7.

*In a small, or medium sized plant what is the best method of increasing boiler capacity during heavy peak loads? Give details and results obtained.*

### ANSWERS.

We think induced draft. Just about installing an outfit.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

Have been using the Parson's system of furnaces in two plants to increase boiler capacity with very good results, obtaining 25 to 40 per cent. more steam from boilers than with hand fire. This system was installed to carry us over the peak load, otherwise we would have had to purchase more boiler capacity and have bought more land for boiler room. We have got as much as double rating from boiler with clean boiler and clean fires; the only requirement being that boiler be kept clean so as not to lose tubes.

—*Lynchburg Traction & Light Co., Lynchburg, Va.,* A. J. KOHLER, *Chief Engineer.*

Increase the grate area. The output of the boiler depends very largely upon the amount of coal that can be burned, which in turn, the draught being good, depends on the grate area. In power station work it is, therefore, of great importance to have a large grate area. While forcing a boiler in this way will necessarily give a high flue temperature, the losses thus caused are not great and only last for a comparatively short time.

Careful firing.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

In a medium sized plant where No. 3 buckwheat coal, or a mixture of No. 3 buckwheat and soft coal are burned the capacity of the boilers can be considerably increased by increasing the percentage of soft coal in the mixture and still make very little smoke. With a mixture half and half of No. 3 buckwheat and soft coal at least 175 per cent. rating can be obtained with less than two inches of air under the grates.

—Alfred Green, 111 *Columbia Heights, Brooklyn, N. Y.*

By blowing superheated steam and air at bridge.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

Raise pressure to limit and use some type of boiler equipment.

—*Public Service Corporation of New Jersey, Newark, N. J.,* R. E. Danforth, *General Manager.*

To increase boiler capacity it is simply necessary to burn more coal, and to burn more coal it is generally necessary to increase the draft. This may be done by steam jets or fans applied under the grates, by suction fans in the stack or chimney flues, or, as is done on board ship, by raising the pressure of air in the whole firing room above that of the atmosphere.

—*Toronto Railway Co., Toronto, Ont.,* Wm. B. Bond, *Chief Electrician.*

## Question 8.

*What schemes are there for inducing firemen to take greater interest in their work? Please give details and results obtained.*

### ANSWERS.

$CO_2$ Recorder.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. Dyer, Jr., *Assistant General Manager.*

Get the right kind of firemen. We can't. We are too near Chicago.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. Thomson, *General Manager.*

Have a chief engineer with a full cargo of sand. If he lacks that element, go into the boiler room yourself and demand that a 6 to 8-in. clean level fire be run; see that the water is kept nearly constant in the boiler; see that these points are carried out to the letter. After one week of this work in the fire-room, the firemen and engineers will see that they have been in the ruts and will be so astounded by the results that they will afterwards try hard to make a good showing. Get the firemen interested to produce a good pressure card.

—*Rockland, Thomaston & Camden Street Railway Co., Rockland, Me.,* THOS. HAWKINS, *General Manager.*

A number of electric railway companies have put in force a premium system for power house employes. The Sheboygan Light, Power & Railway Company of Sheboygan, Wis., has reduced the cost of generating power through the means of a premium system. Taking the cost of power at 1.1 cents per kw-h., which was the average cost before the premium system was started, the company each month divides among the station employes 10 per cent. of the saving whenever the cost per kw-h. for any one month drops below that amount. The division is made according to rank, the engineers receiving the largest amount and the oilers the lowest. The company is paying out in premiums $40 to $80 per month, indicating a saving in power station expenses of $400 to $800 per month. The company states the adoption of the bonus system has brought about a marked improvement, not only in the cost at which power is produced, but in the service in general as well. Every man not only tries to do his best, but also helps the others to do likewise. Engineers watch the firemen to see that the coal is economically burned, and the firemen protest if the engineers run the larger units at low load factor instead of putting in smaller units. Every employe is on the watch for hot bearings, which would mean costly repairs, and carelessness in one employe will not be tolerated by the others.

—*Electric Traction Weekly, Cleveland, O.,* C. B. FAIRCHILD, JR., *Editor.*

Simply watching and checking them.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

By having frequent evaporation tests, considerable rivalry can be developed among the firemen, also by posting in the boiler room the name of the fireman who can evaporate the most water with the least amount of coal and have the smallest amount of combustible matter in the refuse. It could be understood that the man making the best showing will receive the next position as water-tender. The $CO_2$ recording apparatus can be made good use of by posting the record made by different firemen in the boiler room.

—ALFRED GREEN, 111 *Columbia Heights, Brooklyn, N. Y.*

$CO_2$ Recorders, and bonus for high record.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

We accomplished at South Chicago what I considered very satisfactory results by giving the fireman a bonus, depending upon the amount of coal burned per kw-hr. It is comparatively easy to work out such a scheme to meet special conditions though, of course, care must be taken to be fair and to give the fireman adequate bonus for his extra attention. If the fireman gets 1 per cent. of the fuel he can save he generally fares very well.

—*Toronto Railway Co., Toronto, Ont.,* WM. B. BOND, *Chief Electrician.*

## Question 9.

*How can coal pile fires be prevented?*

### ANSWERS.

We never have any.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

Have the coal storage bins built with concrete walls between them so that only a small portion of the coal pile can burn at a time.

—*Little Rock Railway & Electric Co., Little Rock, Ark.,* D. A. HEGARTY, *Treasurer and General Manager.*

By sufficient ventilation to keep the temperature below the combustion point.

—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

Prevent pockets from forming around wood, especially around trestle uprights. Have tried 3.5-in. boiler tubes in a pile of 2,300 tons, but did not prevent fire. The tubes make it convenient to take the temperature and to flood the coal piles with water.

—*Rockland, Thomaston & Camden Street Railway Co., Rockland, Me.,* THOS. HAWKENS, *General Manager.*

Coal containing sulphur is apt to ignite spontaneously. Such coal should not be piled deep and should be closely watched. Vertical tubes, say old boiler tubes, placed in the pile give an opportunity to test the temperature of the pile by means of thermometers.

Keeping down size of pile; taking from center or deepest part.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

If soft coal is to be stored it should be done when the coal is dry and it should be stored on a dry foundation. The coal should not be dropped from any great height as the friction generates heat and it is a fact that coal dropped from great heights is much more liable to spontaneous combustion than when it is thrown up on the pile or dropped from a low elevation. It is not advisable to store coal to a height of over twenty feet. When coal is stored to any great height the pressure at the bottom of the pile is so great that the fire is easily started. In storing soft coal care should be taken not to mix coal from different mines and not to mix anthracite and soft coal. It is advisable to provide as much ventilation as possible.

—Alfred Green, 111 *Columbia Heights, Brooklyn, N. Y.*

Keep coal dry.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

Store good coal.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

Coal pile fires can be remedied by a system of thorough ventilation in the coal storage, especially where the storage is for an indefinite length of time.

—*Knoxville Railway & Light Co., Knoxville, Tenn.,* P. E. Mitchel, *General Superintendent.*

Buy coal comparatively free from sulphur and keep piles less than nine feet in height and on well drained ground.

—*Public Service Corporation of New Jersey, Newark, N. J.,* R. E. Danforth, *General Manager.*

This is generally simply a question of avoiding storing coal in piles that are too high, and also of not permitting the coal to become wet by rain. It is also possible to increase the depth to which coal may be stored safely by providing vents for flues. I believe the practice at the Dominion Iron & Steel Company is that coal may be stored from 15 to 25 feet deep, according to quality of coal and condition of storage.

—*Toronto Railway Co., Toronto, Ont.,* Wm. B. Bond, *Chief Electrician.*

### SHOP CONSTRUCTION.

## Question 10.

*Allowing for additional cost, is it not advisable to have creosoted blocks, or a wood floor, on concrete foundation in the machine, blacksmith and wheel section of a shop, in preference to ordinary concrete floor, which becomes uneven quickly and is hard on workmen walking about?*

### ANSWERS.

Yes.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. Dyer, Jr., *Assistant General Manager.*

Prefer wood floors, as concrete floors are hard on the workmen's feet, and are continually chipping, getting very rough and uneven.

—*Lynchburg Traction & Light Co., Lynchburg, Va.,* A. J. KOHLER, *Chief Engineer.*

Creosoted block makes an exceedingly durable floor for blacksmith shop and general overhauling shop. It is particularly easy on the workmen.

—*United Railways & Electric Co., Baltimore, Md.,* H. H. ADAMS, *Superintendent of Shops.*

I have had experience with concrete floors in shops and barns and have found this class of construction not at all serviceable. My notion of an ideal floor however, is about a 5-in. hardwood creosoted block on about 4-in. of concrete.

—*The Calumet Electric Street Railway Co., Chicago, Ill.,* H. M. SLOAN, *General Manager.*

I believe it advisable to use wood floor on concrete foundation in the wheel section of the shop, but prefer concrete foundation covered with cinders and iron borings for blacksmith shop, with finished concrete floor in the machine shop.

Prefer concrete floor on solid foundation, either grout or solid packed earth.

—*Austin Electric Railway Co., Austin, Texas,* W. J. JONES, *President and Manager.*

See no good reason for this. Will increase insurance rate with wood floor.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

*Advisable yes,* in the particular rooms mentioned. Concrete floors, even if constructed without the faults mentioned, and though perfect in surface, are subject to the chipping of wheel flanges, dropping of tools, moving of machinery by crowbar, etc., and soon with wearing surface broken, the concrete fragments loosened, the floor is a ruin and the second cost of repair or removal is added to the first cost. Ease and warmth to the feet of men in winter time in shops, seldom comfortable at best, would add energy to mind and body and become a money factor on the right side of the shop earnings. To the suggestion of creosote blocks, or wood floors, instead of cement, might be added also, asphaltum flooring, as sanitary, smooth, serviceable and easy to the tread.

*Not advisable.* Construct your floor areas with the same care as to foundations, grades and finish coats (with skilled labor) as is done in all cement sidewalks of our cities and towns, over which the multitudes pass daily with pleasure and comfort and you will not have your "quickly uneven places" or "be hard on the workmen walking about." Shop floors are too quickly constructed by "levelling off the rubbish" in a rush to "clean up," sub-drainage neglected, foundations not dry and settled — the work done in a "mass," floors not laid out in blocks, so as to give expansion at joints, not enough instrument work for levels, put into service before drying out, etc. Good cement flooring, constructed with the care given to street sidewalks, is the most sanitary, useful and permanent form of shop flooring.

— *The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*, Fred G. Simmons, *Superintendent of Construction.*

Yes.

— *Greenville Traction Co., Greenville, S. C.*, H. R. Fothergill, *General Manager.*

A wood floor is much more satisfactory for men to work on than a concrete one, and, when properly constructed, will last for a number of years. For a blacksmith a clay floor properly constructed gives excellent satisfaction.

Yes.

— *Auburn & Turner Railway Co., Turner, Me.*, H. B. Potter, *Manager.*

Would strongly advise wood floors as far as surface of the floor is concerned for any machine or wheel section of the shop; for the blacksmith shop a cinder floor would be the most advisable.

— *Knoxville Railway & Light Co., Knoxville, Tenn.*, P. E. Mitchel, *General Superintendent.*

Wood block for machine shop and wheel room; cinders in blacksmith shop. In overhauling shop concrete with block 18 inches outside of rail.

— *Public Service Corporation of New Jersey, Newark, N. J.*, Chas. Remelius, *Superintendent Rolling Equipment.*

Machine shop, 4 inches of concrete with 1 by 3-in. strips covered with 1.25-in. maple. Blacksmith shop, creosoted blocks.

— *Toronto Railway Co., Toronto, Ont.*, D. McDonald, *Master Builder.*

## Question 11.

*Owing to the breaking of concrete around pit tracks, the inability to secure a safe jacking base and the possibility of shocks to workmen, is not a plank floor preferable to concrete?*

### ANSWERS.

Yes.

— *Auburn & Syracuse Electric Railway Co., Auburn, N. Y.*, R. A. Dyer, Jr., *Assistant General Manager.*

Yes.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

A desirable construction is to bolt a stringer next to the rail and between the concrete floor and the rail thus affording a base support for the jack.

—*United Railways & Electric Co., Baltimore, Md.,* H. H. ADAMS, *Superintendent of Shops.*

I prefer a plank floor between the pits with finished concrete on the outside.

Floors with a top wooden surface are much to be preferred, as they are more agreeable for the men standing upon them. This floor however, must be protected from rot by a proper substructure. A recent specification called for the ground to be well tamped to a level 14 inches below the finished floor line and then covered to a depth of 6 inches with broken stone, the voids being filled with small stone, and the whole being well rolled or rammed into place. This surface was to be liberally covered with hot coal tar and after setting it was to be brought to a level by 1 inch of sand and tar, the sand being heated and thoroughly incorporated with a mixture of two parts of coal and one part of coal tar pitch. On this were to be placed 3 by 4-in. yellow pine zinc-treated sills, the spaces between the sills being filled with tarred sand and packed while hot to a level with the top of the sills. Over this was to be laid a course of 2.75-in. treated yellow pine, this being covered with a layer of roofing felt, and finally a course of 1.25-in. hardwood boards. While such floors are expensive they are very permanent, and we have heard of cases where they have been in use for twenty or thirty years.

—*Electric Traction Weekly, Cleveland, O.,* C. B. FAIRCHILD, JR., *Editor.*

No.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

Yes, but fire hazard is increased.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

If much work is to be done from pit floor then wood flooring would seem to be preferable.

Yes.

—*Auburn & Turner Railway Co., Turner, Me.,* H. B. POTTER, *Manager.*

It all depends on the system of inspection and overhauling. Would recommend plank on wood block 18 inches to 2 feet outside of each rail.

—*Public Service Corporation of New Jersey, Newark, N. J.*, CHAS. REMELIUS, *Superintendent Rolling Equipment.*

## Question 12.

*What is the most desirable construction for an operating car barn, considering cost, maintenance, operating and insurance?*

(1) *Brick walls, mill construction roof.*

(2) *Brick walls, roof iron trusses — 2-in. boards, tar and gravel.*

(3) *Brick walls, reinforced concrete roof.*

(4) *Reinforced concrete walls and roof.*

### ANSWERS.

Brick walls, reinforced concrete roof by all means.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.*, D. THOMSON, *General Manager.*

The most desirable construction for an operating car house is either brick walls or reinforced concrete walls, combined with reinforced concrete columns supporting reinforced concrete beams, girders and roof slabs.

—*United Railways & Electric Co., Baltimore, Md.*, H. H. ADAMS, *Superintendent of Shops.*

Reinforced concrete walls and roof.

Brick walls and mill construction roof with tar and gravel.

—*Austin Electric Railway Co., Austin, Texas*, W. J. JONES, *President and Manager.*

Brick walls, reinforced concrete roof.

—*Green Bay Traction Co., Green Bay, Wis.*, GEO. W. KNOX, *General Manager.*

" Brick walls, roof iron trusses, 2-in. boards, tar and gravel roofing," is *most desirable construction.* Being second in first cost, second in maintenance, second in insurance, and of time-tried and tested service, of almost universal use throughout the transportation and manufacturing world.

—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*, FRED G. SIMMONS, *Superintendent of Construction.*

Brick walls, roof iron trusses, 2-in. boards, tar and gravel.

—*Greenville Traction Co., Greenville, S. C.*, H. R. FOTHERGILL, *General Manager.*

For economy and insurance, brick walls and heavy mill construction, or concrete walls and heavy mill construction is preferable. For insurance without regard to the cost, brick walls and reinforced concrete roof would be preferable. Any construction with steel, unless fireproofed thoroughly, is very unsatisfactory for car barns.

Brick walls, roof iron trusses, 2-in. boards, tar and gravel.

—*Auburn & Turner Railway Co., Turner, Me.*, H. B. POTTER, *Manager.*

The most desirable construction for an operating car barn is concrete foundation with hard burnt brick, steel columns and steel trusses, with 1.75 in. matched roofing covered with tar and gravel, steel girders and concrete floors, with steel rolling doors.

—*Toronto Railway Co., Toronto, Ont.*, D. MCDONALD, *Master Builder.*

### TRACK.

## Question 13.

*What is the life of ties or timber imbedded in concrete?*

### ANSWERS.

I have dug up ties as good as the day they were put down, after being imbedded in concrete ten years.

—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

The Cleveland Electric Railway Company recently had occasion to remove several miles of track that had been laid with different kinds of wooden ties imbedded in 10 inches of broken stone concrete (4 inches under the ties). The track had been down four years. Under exactly the same conditions the white oak ties were found in excellent state of preservation; the chestnut ties were so far gone that they split badly when removed from the concrete with crow bars; the red and black oak ties were absolutely decayed beyond further use.

—*Electric Traction Weekly, Cleveland, O.*, C. B. FAIRCHILD, JR., *Editor.*

18 to 25 years.

—*Green Bay Traction Co., Green Bay, Wis.*, GEO. W. KNOX, *General Manager.*

In Wisconsin cedar ties that have been imbedded in concrete for twelve years are nearly all being used in new work.

— *The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*, FRED G. SIMMONS, *Superintendent of Construction.*

If water proof — 15 years.

— *Greenville Traction Co., Greenville, S. C.*, H. R. FOTHERGILL, *General Manager.*

The first time that tracks were laid on concrete base on this system was in 1892. The concrete was six inches deep just the thickness of the ties, and at the same grade, so that there was no concrete under or on top of them.

In 1898 new rails were laid on the same ties, which were found in perfect condition.

In 1906 these tracks had to be taken up on account of the building of a tunnel and the ties were found in good condition, and if they had not had to be disturbed, would have lasted for a number of years more. So really the experience of this company has not been sufficiently long to show what the life of ties would be even when only partially imbedded in concrete.

Have had white oak in six years and it is in good condition.

— *The Columbus Railway & Light Co., Columbus, Ohio*, C. C. COLLINS, *Assistant General Manager.*

White oak and chestnut, twenty years.

— *Public Service Corporation of New Jersey, Newark, N. J.*, CHAS. REMELIUS, *Superintendent Rolling Equipment.*

## Question 14.

*Is there a standardized specification for track and roadbed?*

### ANSWERS.

We have our standard.

— *Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

Yes.

— *Green Bay Traction Co., Green Bay, Wis.*, GEO. W. KNOX, *General Manager.*

The American Railway Engineering and Maintenance of Way Association has standard specifications for track and roadbed.

— *The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*, FRED G. SIMMONS, *Superintendent of Construction.*

A. S. C. E.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

Yes.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

Most all roads have their own specifications. I do not know of any universal specifications, although the Pennsylvania Railroad is taken as a standard in a great many cases.

—*Public Service Corporation of New Jersey, Newark, N. J.,* M. White, *Superintendent Maintenance of Way.*

## Question 15.

*Which is the best material for ballast on interurban lines, gravel, crushed rock or stone?*

### ANSWERS.

Rock.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. Dyer, Jr., *Assistant General Manager.*

Crushed rock.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. Thomson, *General Manager.*

Good gravel.

—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

Crushed rock first and if too expensive then gravel.

—*Austin Electric Railway Co., Austin, Tex.,* W. J. Jones, *President and Manager.*

Crushed rock, because the sharp points on the stones hold the ties rigid, preventing sun kinks in the line.

—*Rockland, Thomaston & Camden Street Railway Co., Rockland, Me.,* Thos. Hawkens, *General Manager.*

From a practical point of view, the question of ballast for interurban lines is solely a question of what materials are most available. Most of the interurban roads in the Middle West have used gravel, because there is plenty of it. Likewise many of the roads along the Atlantic Seaboard and the Gulf have used clam and oyster shells. In the mining districts of the South, furnace slag as ballast is giving good results. The average interurban road will probably continue to use the most available material. If ballast has to be purchased and hauled a long distance buy broken stone if you can get it.

—*Electric Traction Weekly, Cleveland, O.,* C. B. Fairchild, Jr., *Editor.*

Crushed stone is the best ballast. Gravel when large enough for good drainage, rolls, and it is impossible to keep the track in line.
—*Public Service Corporation of New Jersey, Newark, N. J.,* M. WHITE, *Superintendent Maintenance of Way.*

Gravel.
—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

Good gravel (75 per cent. pebble, 25 per cent. coarse sand), being more generally obtainable than rock or stone, not requiring breaking or crushing, costing less, more adapted to tamping, giving quicker results on new line construction, and easy of maintenance on old work, is the best material for ballast on interurban lines.
—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.,* FRED G. SIMMONS, *Superintendent Construction.*

Stone.
—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Crushed rock.
—*Auburn & Turner Railway Co., Turner, Me.,* H. B. POTTER, *Manager.*

Crushed boulders.
—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

## Question 16.

*What is the best method of handling weeds on interurban roadbeds?*

### ANSWERS.

We cut them down.
—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

By mowing and hoeing.
—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

Cut the roots in the early spring with scuffle hoe and then weed by pulling two or three times during the summer.
—*Electric Traction Weekly, Cleveland, O.,* GEO. S. DAVIS, *Assistant Editor.*

Burn them.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

Cut short, then acid bath.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

We cut them down.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

We use "herbicide" (a poison liquid) for killing weeds on our suburban lines.

—*Knoxville Railway & Light Co., Knoxville, Tenn.,* P. E. Mitchel, *General Superintendent.*

I believe the best method of handling weeds is grubbing them. Ashes are very good to prevent their growth, but it is objectionable on account of spoiling rails and rotting ties.

—*Public Service Corporation of New Jersey, Newark, N. J.,* M. White, *Superintendent Maintenance of Way.*

## Question 17.

*Has the sprinkling of crude oil on the roadbed been tried to lay the dust and kill weeds, and have the results been satisfactory?*

### ANSWERS.

It has been tried but has been found too expensive for average interurban conditions.

—*Electric Traction Weekly, Cleveland, O.,* C. B. Fairchild, Jr., *Editor.*

The use of weed killing preparations has been found satisfactory in some cases but have heard of instances where roads were obliged to pay for cattle poisoned by eating the weeds that had been treated with oil.

—*Electric Traction Weekly, Cleveland, O.,* Geo. S. Davis, *Assistant Editor.*

Expect to try this. Believe from experiments it is the right idea.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

The use of oil to lay dust on roadbed is all right but expensive. I do not think that it would prevent the growth of weeds unless used in very large quantities, which would not be economical.

—*Public Service Corporation of New Jersey, Newark, N. J.,* M. White, *Superintendent Maintenance of Way.*

## Question 18.

*Some companies have laid their tracks with joints directly opposite one another, and as they continue the practice, it must have some advantages, what are they?*

### ANSWERS.

Do not know of any advantages for "Tee" rail. If girder rail the tie rod holes may come better.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. Dyer, Jr., *Assistant General Manager.*

Never could see it. We break ours.

—*DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill.,* D. Thomson, *General Manager.*

•The advantage of having the thump at the low joints at the same time, the saving of one tie in each rail length, and having your curve out of line.

—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

Track laid with square joints preferred as it prevents oscillation and tendency to spread rails.

—*Austin Electric Railway Co., Austin, Texas.,* W. J. Jones, *President and Manager.*

This subject can be considered from four points of view, viz.: maintenance of track, maintenance of rolling stock and equipment, ease in riding and cost of construction. If the track is kept in good condition there should be no difference so far as the operating qualities of the road are concerned. With low joints, however, the opposite joint construction gives a vertical blow to each end of the tie, in case of supported joints, and to each end of the two ties where suspended joints are employed; while with broken joints only one end of the tie is struck a blow by the wheels of the car. This should make the latter form of construction easier to maintain. The blow to each rail should be the same in either case as it is difficult to imagine that a 4-wheel truck would be rigid enough to hold up one wheel the small distance it would drop at a low joint. The effect on the car in one case is a shock on each side at the same time which should be detrimental to axles and motors, and in the other a twist which should be bad for the truck and gears. It is hard to say which is the worse. As regards riding, opposite joints give harder blows to the car and with a single-truck car produce teetering; broken joints give a rocking motion. In construction, opposite joints allow a somewhat more economical arrangement of ties and of cross bonding than broken joints. Staggered joints, *i. e.*, breaking joints by 10-ft. to 15-ft., offer some of the advantages of opposite joints, such as reducing cross bonding, and diminish the rocking motion caused by evenly broken joints.

—*Street Railway Journal, New York, N. Y.*, H. W. Blake, *Editor.*

Broken joints, I find, make it hard to keep the track in alignment; also make the wear and tear much greater on the rolling stock.

—*Rockland, Thomaston & Camden Street Railway Co., Rockland, Me.*, Thos. Hawkens, *General Manager.*

Secure therefrom best operating conditions. Saves racking the cars which occurs with staggered joints.

—*Green Bay Traction Co., Green Bay, Wis.*, Geo. W. Knox, *General Manager.*

One of the disadvantages of "staggered" joints is the galloping motion they are liable to give a car which motion is very liable to derail the short interurban cars even where not affecting long steam railroad coaches. The principal advantage of "even joints" in track construction, over "broken joints" is that the jar in passing over the joints placed opposite so as to occur at the same time or as one, decreases the total number of "jars" 50 per cent. There is a second reason, that in "even joints" there is in a given amount of track, less "rail cutting" in putting in the various classes of special work. But the preponderance of advantage in the "broken joint" method in reducing the force of the "jar" by distributing it, the strengthening of the track, by not having two weaknesses unite at the same place, the better maintenance of line and grade, etc., has led to the adoption of the "broken joint" method by a vast majority of the railroads in the United States.

—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*, Fred G. Simmons, *Superintendent Construction.*

Some say half the number of bumps. I cannot agree with them.

—*Greenville Traction Co., Greenville, S. C.*, H. R. Fothergill, *General Manager.*

In regard to laying tracks with joints in the rails directly opposite one another which is the practice on this road, it can be stated that the advantages are: That when the joints begin to fail and there is a slight pounding of the cars as they pass the joints, such defective places in the track are twice as far apart as they would be if the joints in the rail on one side were located opposite the centers of the rails on the other side. Also that when it is necessary to make repairs to the joints in expensive pavement, with perhaps renewal of ties at the joints, only half the number of excavations are required, which greatly reduces the expense. The old trouble of tracks spreading at the joints which made breaking joints perhaps desirable does not occur with heavy girder rails properly held to gage by large tie rods and laid in pavement.

Cannot see any advantage.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

I have never been able to see the advantage of laying track with joints opposite. Even in the ordinary lay mind it is evident that two weak spots in a rail opposite one another would be very undesirable. Some may contend that it is best to have the low spots of roadbed together, thus causing less oscillation to the rolling equipment but it does not seem that this argument is justifiable with the flexible equipment that is now used.

—*Public Service Corporation of New Jersey, Newark, N. J.,* M. WHITE, *Superintendent Mainteinance of Way.*

## OVERHEAD WORK.

### Question 19.

*Is there a standard and reliable specification form for overhead trolley construction?*

### ANSWERS.

Yes.

—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

Yes.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

Varies, as to the different classes of construction.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

We do not know of any standard for overhead construction as conditions vary according to the radius and elevation of curves, height of trolley wire and type of cars.

—*Public Service Corporation of New Jersey, Newark, N. J.,* E. J. DUNNE, *Superintendent Overhead Lines.*

I do not believe that there is a standard specification for overhead trolley construction, though much has been written on the subject which is available in the proceedings of the various engineering societies and in the scientific press. Modern practice and heavy construction is running toward the catenary form of support. All modern practice is for better work than was done formerly.

—*Toronto Railway Co., Toronto, Ont.,* Wm. B. Bond, *Chief Electrician.*

## Question 20.

*What should be the dimensions of a substantial lightning arrester ground plate for the purpose of grounding station arresters?*

### ANSWERS.

At least 12 to 16 feet of metal (preferably copper) buried in 400 or 500 pounds of gas coke.

—*DeKalb Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. Thomson, *General Manager.*

4 by 6 ft., 0.75-in. thick

—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

Not less than 24-in. square and imbedded in coke or charcoal not less than 6 feet in the ground or where permanent moisture can be assured.

—*Austin Electric Railway Co., Austin, Texas.,* W. J. Jones, *President and Manager.*

Galvanized rods will do out on the line. For station use copper plates which must not be of less area than 36 inches square.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

I figure 1,000 amp. per sq. in. conductor in good bed of iron in powdered coke.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

We use a very satisfactory lighting arrester ground for line work made of a piece of 0.75-in. galvanized iron pipe driven its full length into the ground, and the ground wire soldered to the top of it. For more important installations we use a grounded plate made of a piece of flat copper 14-in. square by 0.75-in. thick with projecting pointed copper pieces running through and soldered to it, this plate being buried six or seven feet in the ground and surrounded by broken coke. We always choose the dampest location possible for placing it. This gives the most satisfactory results.

—*Knoxville Railway & Light Co., Knoxville, Tenn.,* P. E. Mitchel, *General Superintendent.*

About 25 square feet of No. 12-gage copper plate.

—*Public Service Corporation of New Jersey, Newark, N. J.*, E. J. DUNNE, *Superintendent Overhead Lines.*

In general it may be said that the larger the plate the better. I should say that for ordinary purposes a copper or brass plate, having perhaps 20 square feet of superficial area, would be quite satisfactory, though much care must be taken, of course, to see that the plate is planted in permanently damp soil and that the ground connection is fastened to this plate thoroughly well.

—*Toronto Railway Co., Toronto, Ont.*, WM. B. BOND, *Chief Electrician.*

## Question 21.

*What experience have you had with a fuse arrester, viz: an arrester of the type composed of one or more pieces of No. 18 to No. 20 d. c. c. m. w., 16 inches or 18 inches in length, bared at one end and suspended over the positive bus to ground?*

### ANSWERS.

Have had very good results with the fuse arresters, but during a very heavy storm the current has to be cut off to renew wires which have burnt out, as it is dangerous to apply new wires while the storm continues. We prefer grounding positive bus through a water box allowing 15 amperes to flow through during storm.

—*Lynchburg Traction & Light Co., Lynchburg, Va.*, A. J. KOHLER, *Chief Engineer.*

Good arrester but some trouble to keep them "loaded."

—*Green Bay Traction Co., Green Bay, Wis.*, GEO. W. KNOX, *General Manager.*

We have used No. 18 double cotton covered magnet wire in lengths of 16 inches as stated in question No. 21, and while this system took care of lighting discharges, we would not recommend it except in parallel with some other standard type, as the wire or wires have to be replaced after every discharge. For instance, if you have six wires, one or six may act at the same time.

—*Public Service Corporation of New Jersey, Newark, N. J.*, E. J. DUNNE, *Superintendent Overhead Lines.*

I have never had experience such as you describe, but it seems to be based on correct fundamental principles. The object of the lightning arrester is generally conceded to be to permit the lightning charge to escape to earth without permitting the line current to follow through the path established by the lightning charge. The principal objection I can see to the arresters which you describe is that after one discharge this fuse would have to be replaced immediately. In a severe electrical storm this might be rather awkward.

—*Toronto Railway Co., Toronto, Ont.,* WM. B. BOND, *Chief Electrician.*

## Question 22.

*What is the most efficient method of preventing short-circuits by reason of low tension feeders coming in contact with trees?*

### ANSWERS.

Encase wires in wood.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. DYER, JR., *Assistant General Manager.*

Cut the trees.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

Insulation.

—*Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

Trim the trees. If this is not feasible use a wooden sleeve around the feeder.

—*Electric Traction Weekly, Cleveland, O.,* C. B. FAIRCHILD, JR., *Editor.*

Tree insulators and creosoted wood sleeves.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Wooden insulator clamped on feeder. Should be creosoted.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

Wood boiled in oil or creosoted and clamped around the feed wire. Also attach a piece of wood of the proper dimensions by screwing it to the tree. This helps to prevent leakage and it also prevents the wire from wearing through the bark of the tree.

—*Public Service Corporation of New Jersey, Newark, N. J.,* E. J. DUNNE, *Superintendent Overhead Lines.*

I can say that it would be very seldom that short-circuits would arise in this manner, but it is certainly good practice to remove limbs from trees if they come in contact with feeders.

—*Toronto Railway Co., Toronto, Ont.,* WM. B. BOND, *Chief Electrician.*

## Question 23.

*Can sleet be prevented from forming on the trolley by greasing the wires? Has such an idea ever been tried?*

### ANSWERS.

Yes — with success — using petroleum jelly sold as trolley wire grease.

— *DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. Thomson, *General Manager.*

No. Yes.

— *Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.*

The greasing of the trolley wire to prevent sleet, I found to be ineffectual after repeated trials.

— *The Calumet Electric Street Railway Co., Chicago, Ill.,* H. M. Sloan, *General Manager.*

Yes; the writer tried this with good results. The trouble is that greasing the wire is rather expensive, but is very effective.

— *Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

Not by me. I think it is a good one.

— *Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

In the fall of 1892 on the Mountain Route of the Suburban Traction Company, Orange, N. J., we had a lot of trouble with sleet. I heard a remark passed "Why don't they grease the trolley wire." I tried it and found it to be all right. We have not used a sleet cutter or wheel for this route in four winters.

— *John Stephenson Co., Elizabeth, N. J.,* John K. Pischke, *Chief Electrician.*

Been tried. Not successful.

— *The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

Yes, to some extent. This has been tried in 1889, but it was abandoned when a steel scraper was used, which was attached to an 18-ft. pole and held up against the trolley wire by a man on the front platform. This scraper was later attached to the trolley harp in front of the trolley wheel. This was, in turn, superseded by the present sleet wheel.

—*Public Service Corporation of New Jersey, Newark, N. J.,* E. J. DUNNE, *Superintendent Overhead Lines.*

I never heard of greasing trolley wires for this purpose and I am inclined to doubt the efficiency of the scheme. If the wires could be kept greased, I presume sleet could be removed more readily than from ungreased wires after it formed, but I do not believe it to be practicable to keep wires greased sufficiently to do any good.

—*Toronto Railway Co., Toronto, Ont.,* WM. B. BOND, *Chief Electrician.*

### CAR BODIES.

## Question 24.

*What is a good form of monitor deck ventilator for suburban cars, one that will change the air in the car sufficiently and yet not allow annoying draughts in winter?*

### ANSWERS.

High arched roof — no monitors — and metal ventilators.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

Use ventilators hinged at one end and arranged to open at the other. Two ventilator sash being coupled together with an opening device so that one ventilator of the pair may be opened toward the rear of the car. This creates a suction which gives ventilation without draught.

—*United Railways & Electric Co., Baltimore, Md.,* H. H. ADAMS, *Superintendent of Shops.*

I prefer louver ventilators, such as the Perry, without any means of adjustment. We are putting out some cars with twelve louver ventilators, arranged with outside covers for six of them, which covers will be left in place all winter and removed in the summer.

Closed box system, induced draught same as P. R. R. standard.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Have none.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

CAR EQUIPMENT.

## Question 25.

*What is done to prevent brush and brush-holder troubles by operators of fast and heavy equipments?*

### ANSWERS.

Get a well designed motor, and keep brush-holders and commutators clean.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. DYER, JR., *Assistant General Manager.*

Brush-holders and brushes should be inspected daily. Brush-holder springs should be kept at the right tension and the holders should be properly adjusted and well cleaned. Brushes must not be too soft or too hard, but of sufficient hardness to cut the mica, and commutators should be inspected frequently for flat or rough surfaces.

Watchfulness.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

Grind brushes for a neat fit and use heavy springs.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Use good carbon brushes and see that the brush-holders and yokes are in first-class condition and properly adjusted.

—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.,* E. W. OLDS, *Superintendent of Rolling Stock.*

Frequent inspection and cleaning.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

Procure the proper grade of brush suitable for the special service. Keep the brush-holders properly spaced and straight with the commutator bars. In connecting coil leads to commutator bars be sure to start with the exact amount of side lead. Test the field windings and remove any short windings.

—*Syracuse Rapid Transit Railway Co.,* F. M. DUBOIS, *Master Mechanic.*

The importance of using a suitable brush for railway motors has usually been underestimated. As the size of the equipment increases and the voltage is raised, the question of brush quality becomes more and more important. It is safe to say that in most cases 75 per cent. of the trouble and damage due to flashing and arcing on commutator, brush-holders and control apparatus, can be avoided by a small amount of attention to the selection of a proper brush and the inspection of brushes to secure uniformity in quality. The brush manufacturers have some difficulty in producing a uniformally good product and the indifference of operating companies in the matter of quality, has not encouraged them to improve their methods or products. We have, for some time past, been making a close study of the manufacture of carbon brushes, their faults and possible improvements. Carbon brushes may be divided into three broad classes with respect to their composition and use.

1st. A soft, lubricating, low resistance brush which is composed chiefly of graphite and is suitable for the larger sizes of motors which have the mica grooved out of the commutator.

2d. Brushes having a mixture of the soft graphitic carbon and a hard coke. This grade is known as the standard brush and is used in at least 75 per cent. of all railway motors. The proper amount of coke carbon is used to grind the mica down with the copper and to keep the surface of the commutator clean. The graphite lowers the resistance and assists in lubricating the surface of the commutator.

3d. Brushes composed principally of coke. This is a very hard brush and is used for commutators having a large percentage of mica, where considerable grinding action is necessary to keep the mica level with the copper.

—*General Electric Co., Schenectady, N. Y.,* G. H. HILL,
*Assistant Engineer Railway & Traction Department.*

## Question 26.

*Will controller blow-outs be reduced if the fields are connected ahead of the armatures, and why?*

### ANSWERS.

No; but armatures are protected from lightning.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,*
R. A. DYER, JR., *Assistant General Manager.*

Would make no difference.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

Fields should be connected ahead of armature so that they may also protect armatures against lightning.

—*Public Service Corporation of New Jersey, Newark, N. J.,*
CHAS. REMELIUS, *Superintendent Rolling Equipment.*

Controller blow-outs are the result of short-circuits between the controller cylinder or fingers and the frame, there being little or no resistance between trolley and ground in this case, and the very heavy current causes considerable damage to the controller. It is obvious that connecting the fields ahead of the armature can have very little effect on such shorts. If the short occurs in the armature or at the brush holders, the field will be in the circuit between the trolley and ground but, as the resistance is only a fraction of an ohm, it has very little effect in limiting the amount of current. On the other hand, the connection of the fields ahead of the armature has a very bad effect in another way. In case of a ground in the armature, the heavy current resulting, passes through the field and produces an over excited and highly saturated field. The resulting torque in the motor is sufficient to produce a violent "buck," straining and often breaking gears and bending shafts.

—*General Electric Co., Schenectady, N. Y.,* G. H. Hill,
*Assistant Engineer Railway & Traction Department.*

## Question 27.

*Which are preferable, solid or split gears, and why?*

### ANSWERS.

Solid — no bolts to get loose.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,*
D. Thomson, *General Manager.*

Solid gears pressed on axles preferred because if same are put on properly they cannot become loose.

—*United Railways & Electric Co., Baltimore, Md.,* H. H. Adams, *Superintendent of Shops.*

I prefer solid gears on account of gear bolts breaking or nuts becoming loose, often damaging gear, pinion and armature shaft.

Solid gears seem to be coming into general use for both city and interurban service. They hold better when pressed onto the axle with wheel press and there is no danger of bolts becoming stripped and nuts falling off and tearing a gear to pieces as occurs with split gears.

—*Electric Traction Weekly, Cleveland, O.,* Geo. S. Davis, *Assistant Editor.*

Solid, no bolt heads to go into teeth and ruin motors and gears.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

Solid on high speed with proper shop equipment.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergil, *General Manager.*

I always prefer a split gear for the reason that the majority of car houses are not prepared for pressing them on and off. If a solid gear gets clogged up or breaks the road is tied until you throw the car off of the rail so as to change wheels, whereas if it was a split gear you could remedy this inside of 30 minutes or less.

—*John Stephenson Co., Elizabeth, N. J.,* John K. Pischke, *Chief Electrician.*

Solid gears better for high speed. Split gears better for city service.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

Solid gears have proven more satisfactory to us, inasmuch as they bring up truer on the shaft and thereby wear more evenly, besides they never work loose as in the split gear.

—*Knoxville Railway & Light Co., Knoxville, Tenn.,* P. E. Mitchel, *General Superintendent.*

Solid, because they are stronger, do not come loose, and shaft does not have to be key-seated, thus weakening it.

—*West Pennsylvania Railways Co., Connellsville, Pa.,* Geo. W. Wells, *Master Mechanic.*

Solid gears; they are stronger and quickly put on and have no bolts to get loose.

—*Public Service Corporation of New Jersey, Newark, N. J.,* Chas. Remelius, *Superintendent Rolling Equipment.*

Split gears. When cars are operated from one end, gears may be taken off and turned around to permit bearing on both sides of the teeth, without removing axles and wheels. When cars are operated from both ends solid gears are preferable on account of the absence of bolts, the breaking of which causes serious damage.

—*Toronto Railway Co., Toronto, Ont.,* W. R. McRae, *Master Mechanic.*

Solid gears on axles over 4-in. diameter. It prevents the possibility of bolts becoming loose and causing a tie-up and other motor damages; but prefer the split gear on 4-in. axles and under as the diameter of the axle is too small to be sure of a tight gear after being in service.

—*Syracuse Rapid Transit Railway Co.,* F. M. DuBois, *Master Mechanic.*

## Question 28.

*What are the best methods of wiring on open city cars?*

### ANSWERS.

All light wires to be of good quality, having good insulation and thoroughly concealed; all motor cables to be placed underneath the car in asbestos lined boxes of good construction.

Standard form.
—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

Wire conduit with screwed opening and asbestos lined.
—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

Have wiring made up into cables with braided cotton covering treated with a good waterproof paint; run in iron conduits under the car where they are accessible and at the same time not exposed to water from the wheels or injury by the wheels when cars are off the track.
—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.,* E. W. Olds, *Superintendent of Rolling Stock.*

In 3-in. cotton hose painted with insulating waterproof paint.
—*The Columbus Railway & Light Co., Columbus, O.,* C. C Collins, *Assistant General Manager.*

Conduit.
—*West Pennsylvania Railways Co., Connellsville, Pa.,* Geo. W. Wells, *Master Mechanic.*

Wire down through a canvas hose well painted and drawn through another still larger hose and well painted with insulating varnish, tacked up loosely under the floor with leather straps, no wooden cleats to be used as the cable and wires will corrode and rot under them.
—*Syracuse Rapid Transit Railway Co.,* F. M. DuBois, *Master Mechanic.*

## Question 29.

*Which is the more economical, all things considered, hot water or electric heating for cars?*

### ANSWERS.

Hot water.
—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. Thomson, *General Manager.*

Hot water, because it is very much more economical and radiates more evenly.

—*The Calumet Electric Street Railway Co., Chicago, Ill.,*
H. M. Sloan, *General Manager.*

We believe hot water is the more economical for cars over 20 feet in length, inside.

Hot water heaters seem to be giving better satisfaction than electric, especially on the interurban roads. Electric heaters are expensive to operate and consume current at a time when it is most needed — during extremely cold weather. Hot water heaters give an even distribution of heat while electric heaters — especially where placed under seats — radiate only in the immediate vicinity of the heater.

—*Electric Traction Weekly, Cleveland, O.,* Geo. S. Davis,
*Assistant Editor.*

I believe, all things considered, that electric heating is the more economical and the safer.

Hot water.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox,
*General Manager.*

Hot water.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

Hot water.

—*Auburn & Turner Railway Co., Turner, Me.,* H. B. Potter, *Manager.*

Electric.

—*West Pennsylvania Railways Co., Connellsville, Pa.,* Geo. W. Wells, *Master Mechanic.*

It depends on the climate; moderate climate, electric heaters; cold climate, hot water. This is based on a reasonable cost of coal.

—*Public Service Corporation of New Jersey, Newark N. J.,*
Chas. Remelius, *Superintendent Rolling Equipment.*

Hot water is the most economical.

—*Syracuse Rapid Transit Railway Co., F. M.* DuBois,
*Master Mechanic.*

## Question 30.

***What in your opinion should be the requisites and general design for a car coupler for interurban car service?***

### ANSWERS.

Modified M. C. B.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

Should be automatic M. C. B. coupler.

Automatic with spring buffer.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

One that can be automatically coupled with cars standing on a curve or track with uneven surface, and will not uncouple when passing around short radius curves.

—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.,* E. W. OLDS, *Superintendent of Rolling Stock.*

Standard M. C. B. same as used on steam railroads.

—*Auburn & Turner Railway Co., Turner, Me.,* H. B. POTTER, *Manager.*

## Question 31.

***Are the results obtained from the use of a high grade brass motor bearing so much more satisfactory than a babbitted bearing to warrant the additional cost?***

### ANSWERS.

No.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. DYER, JR., *Assistant General Manager.*

Not with us.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

Considering the scrap, we believe they are.

Do not think so.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

No.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

No.

—*Auburn & Turner Railway Co., Turner, Me.,* H. B. Potter, *Manager.*

Yes, on large axles or where an excessive amount of bronze is not required.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

We have not found it so; our best results are from pure babbitt metal, properly lubricated. Our experience leads us to believe that the most expensive bearing metal produced is not better than the cheapest if not properly lubricated.

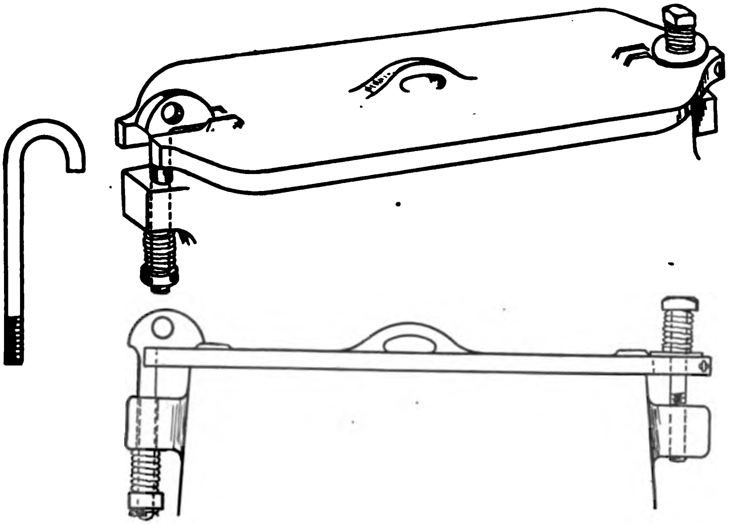
—*Toronto Railway Co., Toronto, Ont.,* W. R. McRae. *Master Mechanic.*

## Question 32.

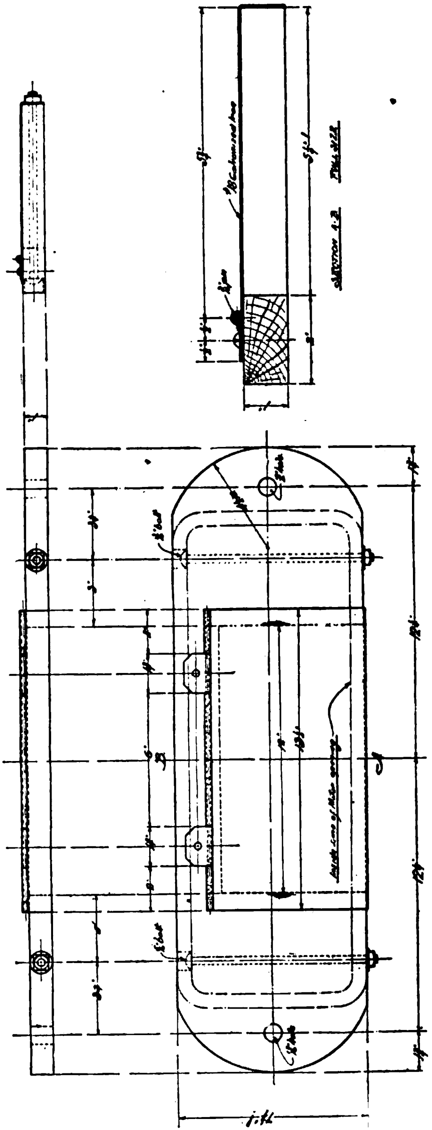
*Is there any motor lid for the railway motor that can be removed and replaced daily without any danger of it being lost into streets or into motor?*

### ANSWERS.

See attached sketch of motor lid fastening designed by myself, which is very easily operated, and most efficient. We do not have lids lost or rattling.



—*Toronto Railway Co., Toronto, Ont.,* W. R. McRae, *Master Mechanic.*



Motor Lid for Railway Motor.

—*Public Service Corporation of New Jersey, Newark, N. J.,*
Chas. Remelius, *Superintendent Rolling Equipment.*

## Question 33.

*Is there any method by which carbon brushes for railway motors can be tested without a running test to determine whether they are of the same grade as before used?*

### ANSWERS.

Think not.

—*Green Bay Traction Co., Green Bay, Wis.*, GEO. W. KNOX, *General Manager.*

Not that I know of.

—*Greenville Traction Co., Greenville, S. C.*, H. R. FOTHERGILL, *General Manager.*

No reliable test as far as we know.

—*Public Service Corporation of New Jersey, Newark N. J.*, CHAS. REMELIUS, *Superintendent Rolling Equipment.*

It is a very easy matter to distinguish different grades of brushes by scratching with a knife, observing the ease with which they may be cut and the sound produced by scratching. A little practice will enable anyone to classify the brush as to its hardness.

Aside from the matter of grade it is important to detect certain faults in the brushes. Some of the faults are:

1. Spongy, or cellular construction, which is produced by overheating of the squirting die, by insufficient pressure, or by the presence of a small amount of moisture when the brush is baked. This can be detected by the appearance of the brush or by scratching or cutting with a knife. Such brushes will weigh less than a brush of proper compactness. They will wear rapidly and produce an abnormal amount of dust and smudging on the commutator which results in flashing.

2. The stratified construction of the brush. When the brush is broken it will present the appearance of slate shale showing that the brush is apparently composed of a number of layers which are poorly joined together. This results from the outer layers sticking in the squirting die so that portions of the mixture slide over each other, and such a brush will easily chip off at the edges, affording an insufficient contact with the commutator and producing sparking and overheating.

The best way to inspect for stratification is to break a small percentage of the brushes received and if they show a stratified construction, the entire lot should be rejected. Often a stratified brush may be detected by examining the edge, but unfortunately, some manufacturers have recently made a practice of covering the edge of the brush with a carbon paste which conceals the small cracks indicating stratification.

The General Electric Co. has found it necessary to inspect all the brushes received. About 100,000 are inspected each month by one man who has naturally, become very expert and can accurately and rapidly select and grade the brushes. As above stated, however, it is comparatively easy to grade the brushes and cull out imperfect ones to an extent which will make a great improvement in operation, and every operating company should give this careful attention. The cost of the brush is a very small item compared with the results from flashing motors and will not be considered if proper attention is paid to the selection of the brush and a comparison made as to the results on the equipment.

—*General Electric Co., Schenectady, N. Y.,* G. H. Hill, *Assistant Engineer Railway & Traction Department.*

## Question 34.

*Has anyone experienced trouble with loose field coils in the newer types of motors, and what can be done to prevent it?*

### ANSWERS.

Look after the bolts holding fields in place.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. Dyer, Jr., *Assistant General Manager.*

We have experienced some trouble with loose fields in newer types of motors, which have been remedied by putting additional liners between pole-piece and field.

—*United Railways & Electric Co., Baltimore, Md.,* H. H. Adams, *Superintendent of Shops.*

I have experienced no trouble in this respect.

Not particularly.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

No.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

Yes. Give them close inspection, and when showing any indication of becoming loose, see that they are properly tightened, using shims.

—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.,* E. W. Olds, *Superintendent of Rolling Stock.*

Yes. Insert heavy canvas gasket.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

No.

—*Auburn & Turner Railway Co., Turner, Me.,* H. B. POTTER, *Manager.*

Pack field coils with oiled canvas liners.

—*Toronto Railway Co., Toronto, Ont.,* W. R. MCRAE, *Master Mechanic.*

Put canvas gaskets dipped in insulating varnish behind the fields and tighten them with forms enough to take away all looseness.

—*Syracuse Rapid Transit Railway Co.,* F. M. DUBOIS, *Master Mechanic.*

## Question 35.

*What is the best way to straighten armature shafts that are sprung between pinions and bearings without removing the winding or shaft from the core?*

### ANSWERS.

We have straightened them by mounting in a lathe.

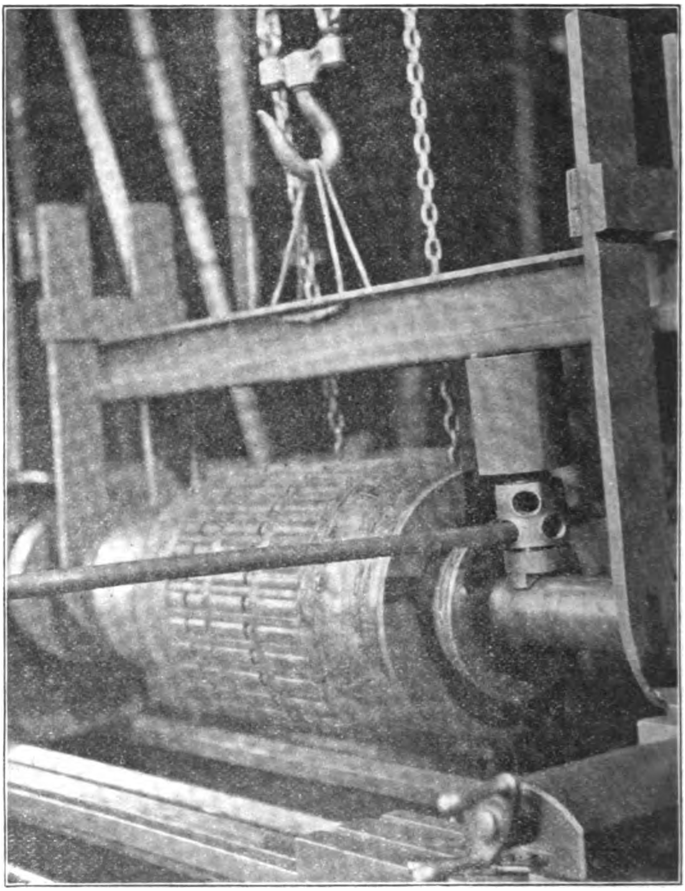
—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

Have straightened armature shafts which have been bent between pinion and bearing, by heating them with a large Bunsen burner, using city gas, and have been enabled to true them.

—*Lynchburg Traction & Light Co., Lynchburg, Va.,* A. J. KOHLER, *Chief Engineer.*

Nearly every shop uses different methods, generally having home-made apparatus for this purpose.

One armature shaft straightener, shown in cut, consists of a pair of heavy yokes with cross pieces near the top and a section of 60-lb. "Tee" rail. The armature and shaft are placed on centers in the lathe, the ends of the shaft being first slipped through the yokes. The section of "Tee" rail is then slipped under the cross pieces by an overhead carrier. The upper portion of the screw was made from a piece of an axle and has a pair of small lugs at the top to accommodate the width of the head of the "Tee" rail, preventing this portion of the screw from turning. The lower portion is shaped to fit the shaft and has a projection which fits up into the center section of the screw. By turning this center section with a long lever the shaft at the point of bend is forced downward while a lifting strain is imparted by the yoke nearest the bend. By this method no strain is brought upon the center pins and it is very easy to straighten out the bend.



METHOD OF STRAIGHTENING BENT ARMATURE SHAFT.

—*Electric Traction Weekly, Cleveland, O.,* C. B. FAIRCHILD, JR., *Editor.*

Tight fitting extension piece and press.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Heat with blow torch and straighten with sledge.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

Use a furnace built with loose fire brick and heat with gas or gasoline torches and straighten in a lathe with a jack.

—*West Pennsylvania Railways Co., Connellsville, Pa.,* GEO. W. WELLS, *Master Mechanic.*

Can be done on axle-straightening machine.

—*Public Service Corporation of New Jersey, Newark N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

In lathe centers, cold, with screw straightener.

—*Toronto Railway Co., Toronto, Ont.,* W. R. MCRAE, *Master Mechanic.*

## Question 36.

*Should armatures rewound or repaired be balanced before being put in service?*

### ANSWERS.

Yes.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. DYER, JR., *Assistant General Manager.*

Most assuredly.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

Yes.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

Only roughly.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

No. If the cores are properly balanced before being rewound.

—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.,* E. W. OLDS, *Superintendent of Rolling Stock.*

Yes.

—*Auburn & Turner Railway Co., Turner, Me.,* H. B. POTTER, *Manager.*

Not necessarily.
—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

Not necessary where coils are properly made.
—*Public Service Corporation of New Jersey, Newark N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

## Question 37.

*Which is the more economical for finishing armatures, the higher priced, smooth, hard oil-proof varnish at about $1.50 per gallon, or a grade costing about 75 cents per gallon, and which has not all the qualities mentioned above?*

### ANSWERS.

The higher priced.
—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

Material cheap in first cost is sometimes very expensive in the end.
—*Public Service Corporation of New Jersey, Newark N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

Best way of making determination in relation to insulating varnish is to have it tested by some of the testing laboratories which will give reports on material of this character.
—*United Railways & Electric Co., Baltimore, Md.,* H. H. ADAMS, *Superintendent of Shops.*

I believe a grade costing from 75c. to $1 per gallon does as well as the higher priced.

Best grade, $1.50.
—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

The best you can buy and one that will dry and not afterward absorb moisture.
—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Best grade, $1.50 per gallon.
—*Auburn & Turner Railway Co., Turner, Me.,* H. B. POTTER, *Manager.*

Varnish at $1 per gallon.
—*The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

## Question 38.

*What is the average cost of equipping double-truck cars with four motors and air brakes, including the wiring, mounting motors, piping, etc.?*

### ANSWERS.

Depends on size of car and motors.
—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. Thomson, *General Manager.*

In equipping a lot of 100 cars the installation of air brakes, including piping and fittings averaged $31.78 per car; mounting of motors and wiring averaged $31.24 per car; unloading of the electrical equipment, air brake equipment, the cleaning up of the car before placing in service averaged $3.71 per car, making a total of $66.73. This figure includes an allowance for shop expense—four motor equipments with K-28 B controllers and straight air brakes.
—*United Railways & Electric Co., Baltimore, Md.,* H. H. Adams, *Superintendent of Shops.*

Unable to answer without knowing types of motors or for service required.

## Question 39.

*Give formula of babbitt used for your own journals.*

### ANSWERS.

For armature journals, add to 90-lb. of tin, 10-lb of copper and 10-lb antimony.
—*The Calumet Electric Street Railway Co., Chicago, Ill.,* H. M. Sloan, *General Manager.*

87 per cent. tin, 13 per cent. antimony.
—*Public Service Corporation of New Jersey, Newark N. J.,* Chas. Remelius, *Superintendent Rolling Equipment.*

63 per cent. tin; 25, lead; 3, copper; 9, antimony.
—*Toronto Railway Co., Toronto, Ont.,* W. R. McRae, *Master Mechanic.*

## Question 40.

*Give formula of material used in trolley wheels.*

### ANSWERS.

96 per cent. copper, 4 per cent. tin.

—*Public Service Corporation of New Jersey, Newark N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

## Question 41.

*Is it practical to use the same kind of a fender on city and interurban cars?*

### ANSWERS.

No.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. DYER, JR., *Assistant General Manager.*

No.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

No.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

No.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

No.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

Yes.

—*Public Service Corporation of New Jersey, Newark N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

## Question 42.

*What are the arguments in favor of a pilot for purely interurban service?*

### ANSWERS.

Pilots are the only practical thing for high speed, and just as good probably in case of striking a person, as a fender.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. DYER, JR., *Assistant General Manager.*

Won't drop down and is strong enough to push off large obstructions.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,*
D. Thomson, *General Manager.*

For the same reason that some steam railroads use a pilot on an engine to remove obstructions from the track that with a fender would pass underneath the truck and likely derail the car.

A fender striking an object at high speed usually goes to pieces and the object gets under the trucks frequently causing derailments, whereas the pilot will usually throw the object from the track without damage either to the pilot or car.

—*Electric Traction Weekly, Cleveland, O.,* Geo. S. Davis,
*Assistant Editor.*

Safest and cheapest.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox,
*General Manager.*

Strength to knock and not pick up.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

To keep cars from being derailed when striking cattle.

—*West Pennsylvania Railways Co., Connellsville, Pa.,* Geo. W. Wells, *Master Mechanic.*

It is better able to stand the impact of a heavy object against cars running at high speed and it has also a greater tendency to throw the object struck to the side of the track.

—*Public Service Corporation of New Jersey, Newark N. J.,*
Chas. Remelius, *Superintendent Rolling Equipment.*

## WHEELS AND AXLES.

## **Question 43.**

### *Why are chilled iron wheels preferable in interurban service to steel tired wheels?*

### ANSWERS.

They are not.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,*
R. A. Dyer, Jr., *Assistant General Manager.*

Don't think they are, although we use them on account of low cost.
—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

Steel wheels are best for interurban service.
—*United Railways & Electric Co., Baltimore, Md.,* H. H. ADAMS, *Superintendent of Shops.*

Do not believe they are.

Do not believe chilled wheels are preferable in interurban service to steel tired wheels. The chilled wheel chips more readily than the steel wheel, especially in cold weather. Narrow special work and frogs and switches chip the chilled wheels, making them dangerous on high speed service.
—*Electric Traction Weekly, Cleveland, O.,* GEO. S. DAVIS, *Assistant Editor.*

Steel tired wheels are much to be preferred owing to their being less liable to break. Also, they are probably cheaper than chilled wheels, owing to their lesser liability to skid flat and, if skidded flat, will usually, if left in service, roll the skid out.

They are not.
—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

We do not think they are.
—*West Pennsylvania Railways Co., Connellsville, Pa.,* GEO. W. WELLS, *Master Mechanic.*

They are not on high speed service. Chilled iron wheels are all right in city and surburban service where the maximum speed is not over twenty-five miles an hour.
—*Public Service Corporation of New Jersey, Newark N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

## Question 44.

*What causes car axles to crack and break?*

### ANSWERS.

Crystallization, changes in diameter and cutting key slots in body of axle.
—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. DYER, JR., *Assistant General Manager.*

Crystallization.

— *DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. Thomson, *General Manager.*

Generally the breakage is due to crystallization.

— *United Railways & Electric Co., Baltimore, Md.,* H. H. Adams, *Superintendent of Shops.*

Crystallization.

My experience has been that the flange way on railroad crossings is much too narrow for the wheel flanges thus making a wedging effect on the inside of the wheels and causing the axles to become crystallized.

— *Rockland, Thomaston & Camden Street Railway Co., Rockland, Me.,* Thos. Hawkens, *General Manager.*

Too small in size.

— *Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

Overheating, and rough special work.

— *Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

Crystallization, caused by springing and vibration.

— *The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.,* E. W. Olds, *Superintendent of Rolling Stock.*

Generally softening of steel in hot boxes.

— *Auburn & Turner Railway Co., Turner, Me.,* H. B. Potter, *Manager.*

Crystallization and change of temperature.

— *The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

Flaws in axle; strain at key way; too small a diameter.

— *West Pennsylvania Railways Co., Connellsville, Pa.,* Geo. W. Wells, *Master Mechanic.*

Crystallization and being too light in cross section.

— *Public Service Corporation of New Jersey, Newark, N. J.,* Chas. Remelius, *Superintendent Rolling Equipment.*

Principally, bad track and tight gage.

— *Toronto Railway Co., Toronto, Ont.,* W. R. McRae, *Master Mechanic.*

Motors and trucks are not designed to receive large enough axle to stand the severe service of the constant pound, causing the grain of the steel to slightly give, thus causing a flaw which will extend through the axle after dirt and water enter.

—*Syracuse Rapid Transit Railway Co.,* F. M. DuBois, *Master Mechanic.*

## Question 45.

*Is a drop test sufficient to detect flaws in axles, provided it is calculated to be about equal to service conditions plus a proper factor of safety?*

### ANSWERS.

The standard drop test of the Erie Railroad Co., consisting of five blows at 29 ft. of weight, weighing 1,640 lb., axle resting on 3-ft. 6-in. centers, is considered sufficient.

—*Toronto Railway Co., Toronto, Ont.,* W. R. McRae, *Master Mechanic.*

## Question 46.

*What is the average life of 4, 4.5 and 5-inch cold rolled steel axles under cars having four motor equipments, ranging from 15 to 27 tons?*

### ANSWERS.

Three to four years. Not that in some cases.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

Have some that have run 150,000 miles.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

From three to five years according to conditions of track and surface.

—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.,* E. W. Olds, *Superintendent of Rolling Stock.*

One and one-half years.

—*Auburn & Turner Railway Co., Turner, Me.,* H. B. Potter, *Manager.*

Eight to ten years.

—*The Columbus Railway & Light Co., Columbus, O.*, C. C. COLLINS, *Assistant General Manager.*

## Question 47.

*What is the chief factor in determining when a steel wheel should be turned down in the lathe, i. e., is it flange wear, tread wear, diameter or what? About how often is it found necessary to turn them?*

### ANSWERS.

Flange wear always and this depends largely on characteristics of road, viz.; curves, speed and use of brake. Average run between turnings 40,000 to 60,000 miles.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.*, R. A. DYER, JR., *Assistant General Manager.*

Both flange wear and tread wear, as well as diameter should be considered, although generally the flange is the most important. It all depends on mileage, condition of track, speed and curves as to how often they should be turned.

Flange wear. Every 20,000 mile service.

—*Green Bay Traction Co., Green Bay, Wis.*, GEO. W. KNOX, *General Manager.*

Generally speaking, flange wear.

—*The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.*, E. W. OLDS, *Superintendent of Rolling Stock.*

Flange wear.

—*The Columbus Railway & Light Co., Columbus, O.*, C. C. COLLINS, *Assistant General Manager.*

Tread wear into double flange. Average about 50,000 miles.

—*West Pennsylvania Railways Co., Connellsville, Pa.*, GEO. W. WELLS, *Master Mechanic.*

Flange wear. Steel wheels should be turned whenever gage indicates necessity. Length of time wheel will run depends on local conditions.

—*Public Service Corporation of New Jersey, Newark, N. J.*, CHAS. REMELIUS, *Superintendent Rolling Equipment.*

Steel wheels should be turned down when one flange begins to get thinner than the other or when one wheel begins to get slightly smaller in diameter, as this will soon wear one flange thinner than the other. Otherwise, allow them to run as long as they show no tendency to crowd sideways.

—*Syracuse Rapid Transit Railway Co.,* F. M. DuBois, *Master Mechanic.*

### INSPECTION.

## Question 48.

*How often should clearance of motors be taken?*

### ANSWERS.

Depends on service.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. Thomson, *General Manager.*

The clearance of motors should be determined whenever the equipment is in for regular weekly or periodical inspection.

—*United Railways & Electric Co., Baltimore, Md.,* H. H. Adams, *Superintendent of Shops.*

Every three days on interurban equipment and daily on the smaller city equipment.

Every ten days.

—*Austin Electric Railway Co., Austin, Texas,* W. J. Jones, *President and Manager.*

Three times a week.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

First sixty days once a week, after that every two days if on regular run.

—*Greenville Traction Co., Greenville, S. C.,* H. R. Fothergill, *General Manager.*

Once a week.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. Collins, *Assistant General Manager.*

Once a day.

—*West Pennsylvania Railways Co., Connellsville, Pa.,* Geo. W. Wells, *Master Mechanic.*

At least once a month.

—*Public Service Corporation of New Jersey, Newark, N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

Armature clearance should be taken twice a week.

—*Toronto Railway Co., Toronto, Ont.,* W. R. MCRAE, *Master Mechanic.*

Every two weeks.

—*Syracuse Rapid Transit Railway Co.,* F. M. DUBOIS, *Master Mechanic.*

## Question 49.

***In maintaining rolling stock, what is a fair average in cars per man for the maintenance of trucks and electrical equipments at car houses?***

### ANSWERS.

On a road having four-motor and two-motor equipments (on double and single trucks respectively), an average of 7.7 cars per man.

—*United Railways & Electric Co., Baltimore, Md.,* H. H. ADAMS, *Superintendent of Shops.*

It all depends on conditions.

Four cars per man.

—*Austin Electric Railway Co., Austin, Texas,* W. J. JONES, *President and Manager.*

Three to four cars.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

Six per man; double-truck.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Eight regulars and eight extras per man.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

Now operate 24 regular cars out of three barns — all interurban work. Have 24 men, including foremen, inspectors, repairmen and car cleaners.

—*West Pennsylvania Railways Co., Connellsville, Pa.,* GEO. W. WELLS, *Master Mechanic.*

Four to six men according to service.

—*Public Service Corporation of New Jersey, Newark, N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

Mixed equipments, double and single-trucks, modern motors, 14 cars per man; old style of equipment, 10 cars per man. (Answer to No. 50 also.)

—*Toronto Railway Co., Toronto, Ont.,* W. R. MCRAE, *Master Mechanic.*

Including painting, carpenter, machine and all repair work on cars, two cars to every man.

—*Syracuse Rapid Transit Railway Co.,* F. M. DUBOIS, *Master Mechanic.*

## Question 50.

*What is a fair average in motors per man?*

### ANSWERS.

On a road having four-motor and two-motor equipments (on double and single-trucks respectively), there is an average of 19.2 motors per man.

—*United Railways & Electric Co., Baltimore, Md.,* H. H. ADAMS, *Superintendent of Shops.*

It all depends on conditions.

Six motors per man.

—*Austin Electric Railway Co., Austin, Texas,* W. J. JONES, *President and Manager.*

Ten to twelve motors per man,

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

Twelve, exclusive of winding.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Sixteen regulars and sixteen extras per man.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

Two men can take care of 300 motors in excellent manner.

—*Syracuse Rapid Transit Railway Co.,* F. M. DUBOIS, *Master Mechanic.*

LUBRICATION.

### Question 51.

*What is the most economical depth of oil to use in the oil wells of the armature bearings of the G. E, 80 or 101-B motors? State length of time between oilings for the various depths to be mentioned.*

**ANSWERS.**

Our practice is to place in each G. E. 80-motor bearing a gill of oil every five days. On 101-B motors with oil wells carrying a depth of 4 inches of oil, they will run one month without additional oil, but 2 inches of oil is recommended as a good depth with an inspection every five days.

—*United Railways & Electric Co., Baltimore, Md.,* H. H. ADAMS, *Superintendent of Shops.*

Saturate waste every other day.

—*The Columbus Railway & Light Co., Columbus, O.,* C. C. COLLINS, *Assistant General Manager.*

One inch. Oil every seven days.

—*Public Service Corporation of New Jersey, Newark, N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

1.5 to 2-in. Add one-half a gill of oil once a week.

—*Toronto Railway Co., Toronto, Ont.,* W. R. MCRAE. *Master Mechanic.*

Oil should be kept about 2.5-in. deep in the 101-B Westinghouse railway motor and oiled every three days.

—*Syracuse Rapid Transit Railway Co.,* F. M. DUBOIS, *Master Mechanic.*

### Question 52.

*Which gives the better results for lubrication of gears, grease or a heavy oil?*

**ANSWERS.**

Combination of both where cars are high speed.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. DYER, JR., *Assistant General Manager.*

Grease with wool filler.
—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.*, D. THOMSON, *General Manager.*

A heavy oil gives good lubrication for gears.
—*United Railways & Electric Co., Baltimore, Md.*, H. H. ADAMS, *Superintendent of Shops.*

We prefer grease.

Grease, by all means.
—*Austin Electric Railway Co., Austin, Texas,* W. J. JONES, *President and Manager.*

Grease.
—*West Pennsylvania Railways Co., Connellsville, Pa.*, GEO. W. WELLS, *Master Mechanic.*

Grease.
—*Public Service Corporation of New Jersey, Newark, N. J.*, CHAS. REMELIUS, *Superintendent Rolling Equipment.*

Heavy oil or good gear compound.
—*Toronto Railway Co., Toronto, Ont.*, W. R. MCRAE, *Master Mechanic.*

Heavy cork and graphite grease softened with oil.
—*Syracuse Rapid Transit Railway Co.*, F. M. DUBOIS, *Master Mechanic.*

Heavy oil.
—*Green Bay Traction Co., Green Bay, Wis.*, GEO. W. KNOX, *General Manager.*

Heavy oil.
—*Greenville Traction Co., Greenville, S. C.*, H. R. FOTHERGILL, *General Manager.*

Grease.
—*Auburn & Turner Railway Co., Turner, Me.*, H. B. POTTER, *Manager.*

Grease.
—*The Columbus Railway & Light Co., Columbus, O.*, C. C. COLLINS, *Assistant General Manager.*

## Question 53.

*What is the best simple shop test of lubricating oils and greases, including gear grease?*

### ANSWERS.

No shop test is given.

Not any good (under average conditions).
—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

Heat test, and ultimate destruction by heat.
—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Ask Mr. Alfred Green.
—*Public Service Corporation of New Jersey, Newark, N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

Specific gravity and flash test on oils, chemical analysis on grease.
—*Toronto Railway Co., Toronto, Ont.,* W. R. MCRAE, *Master Mechanic.*

## Question 54.

*What is the best way of cleaning cars?*

### ANSWERS.

Depends upon how much money you have to spend. An ideal method would be to sweep and dust every three hours and wash the car every twenty-four hours.
—*Public Service Corporation of New Jersey, Newark, N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

Clean the interior of cars by compressed air and vacuum. Ordinarily where circumstances will permit, wash the exterior of the cars with clean running water, using a soft brush, preferably a brush with jet or spray in it. Where cars are very dirty use oil soap which is as free as possible from lyes or acids, and wash off with the spray brush as above.
—*Toronto Railway Co., Toronto, Ont.,* W. R. MCRAE, *Master Mechanic.*

Brush, broom, rags and good elbow grease behind them.
—*Syracuse Rapid Transit Railway Co.,* F. M. DUBOIS, *Master Mechanic.*

## Question 55:

*As the operating department deals with and receives complaints from the public as to the cleanly condition of the cars, why is it not best to have our cleaning come under the operating end, provided the advice of the master mechanic is adhered to regarding the use of proper cleaning compounds which will not prove injurious to the paint?*

### ANSWERS.

The master mechanic is the one responsible for the life, appearance and condition of the paint and varnish on the car. The proper or improper cleaning of a car has a vital effect on the paint and varnish. Therefore by all means let the master mechanic have full charge of the cleaning of cars. Responsibility without authority is bad practice.

—*Electric Traction Weekly, Cleveland, O.,* C. B. Fairchild, Jr., *Editor.*

Our operating department is responsible for and does the car cleaning, working under the general directions of the mechanical department.

It is.

—*Green Bay Traction Co., Green Bay, Wis.,* Geo. W. Knox, *General Manager.*

It is.

—*Auburn & Turner Railway Co., Turner, Me.,* H. B. Potter, *Manager.*

Depends entirely upon local conditions. As a general thing divided authority in car houses is a mistake.

—*Public Service Corporation of New Jersey, Newark, N. J.,* Chas. Remelius, *Superintendent Rolling Equipment.*

The operating department should look after and be responsible for the cleanliness of cars. The material in cleaning to be subject to approval of the master car builder or foreman painter.

—*Toronto Railway Co., Toronto, Ont.,* W. R. McRae, *Master Mechanic.*

## Question 56.

*What systematic and periodic method is there for taking up with the general manager or transportation department a record of the cars turned in from the road due to faulty or negligent operation on the part of the trainmen? What is done to prevent a repetition of the faults?*

### ANSWERS.

Daily report. Complaints from the mechanical department are submitted to transportation heads and their subordinates. Men guilty of negligence are cautioned or disciplined.

—*Public Service Corporation of New Jersey, Newark, N. J.,*
CHAS. REMELIUS, *Superintendent Rolling Equipment.*

Both the general manager and master mechanic are supplied with a daily detailed statement of crippled cars for the entire service. If any undue increase of cripples is shown, the matter is taken up at once and remedied. In case of cars turned in from the road owing to abuse, or from other unsatisfactory reasons, the master mechanic immediately notifies the divisional superintendent in charge of the division to which the car belongs, and he, in turn, disciplines the motorman who is at fault.

—*Toronto Railway Co., Toronto, Ont.,* W. R. MCRAE,
*Master Mechanic.*

References to the subject matter of this question may be found in the *Electric Traction Weekly,* as follows:

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| May 9, 1907 | 433 |
| May 16, 1907 | 457 |
| June 20, 1907 | 585 |
| May 30, 1907 | 508 |
| May 23, 1907 | 495 |

—*Editor Question Box.*

## Question 57.

*Is a long or short pull register preferable, and why?*

### ANSWERS.

Rod and lever every time.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,*
D. THOMSON, *General Manager.*

Short.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

Short; does not fool public or inspector.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Where the register is operated with a cord a long pull is preferable because it is then impossible to play tunes on the register. It is difficult to use a long pull register when operated with rod fixture.

—*Public Service Corporation of New Jersey, Newark, N. J.,* CHAS. REMELIUS, *Superintendent Rolling Equipment.*

## Question 58.

*What is the best method of checking motormen on the operation of controller with reference to care of equipment and saving of power?*

### ANSWERS.

Automatic accelerating controller.

—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.,* R. A. DYER, JR., *Assistant General Manager.*

Put on meters.

—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,* D. THOMSON, *General Manager.*

By a mechanical check on the controller.

—*The Calumet Electric Street Railway Co., Chicago, Ill.,* H. M. SLOAN, *General Manager.*

Use automotoneers.

—*Austin Electric Railway Co., Austin, Texas,* W. J. JONES, *President and Manager.*

Put on an automotoneer.

—*Green Bay Traction Co., Green Bay, Wis.,* GEO. W. KNOX, *General Manager.*

Meter test of each car on the run.

—*Greenville Traction Co., Greenville, S. C.,* H. R. FOTHERGILL, *General Manager.*

Watch the meters at sub-stations.

—*Auburn & Turner Railway Co., Turner, Me.,* H. B. POTTER, *Manager.*

## Question 59.

*What is the best method of instructing student motormen in the mechanical operation of both city and interurban cars?*

### ANSWERS.

Skeleton cars or instruction cars in charge of capable instructor.
—*Toronto Railway Co., Toronto, Ont.,* W. R. McRae,
*Master Mechanic.*

References to the subject matter of this question may be found in the *Electric Traction Weekly,* as follows:

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| May 16, 1907 | 458 |
| June 20, 1907 | 583 |
| June 27, 1907 | 611 |
| July 4, 1907 | 625 |
| July 25, 1907 | 697 |
| Aug. 1, 1907 | 721 |
| Aug. 22, 1907 | 793 |

—*Editor Question Box.*

## Question 60.

*In how great detail should the mileage of parts of equipment be kept?*

### ANSWERS.

Wheels, trolley wheels, motor gears and pinions.
—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.,*
D. Thomson, *General Manager.*

We keep the absolute daily mileage of each car. In this way the mileage of any particular part can be easily kept. We always keep the mileage of certain parts, such as armatures. Entry is made on the car card of when the armature goes into service; another entry when it comes out of service; the mileage run by the car between these two dates is thus easily drawn off.

Believe in keeping individual mileage on parts of equipments only for test purposes. In all other cases the average mileage can be determined by keeping the mileage of each type of motor.
—*Public Service Corporation of New Jersey, Newark N. J.,*
R. E. Danforth, *General Manager.*

## Question 61.

*What should be the angle between trolley pole and wire?*

### ANSWERS.

Do not know the angle but a short pole is preferable to a long one.
—*Auburn & Syracuse Electric Railway Co., Auburn, N. Y.*, R. A. Dyer, Jr., *Assistant General Manager.*

About 45°.
—*DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.*, D. Thomson, *General Manager.*

About 45°.
—*United Railways & Electric Co., Baltimore, Md.*, H. H. Adams, *Superintendent of Shops.*

45°, as at this angle the trolley wheel will follow the wire better and a more nearly even pressure is maintained.
—*Austin Electric Railway Co., Austin, Texas*, W. J. Jones, *President and Manager.*

30°.
—*Green Bay Traction Co., Green Bay, Wis.*, Geo. W. Knox, *General Manager.*

40°, with 35-lb. pull at end of pole.
—*Greenville Traction Co., Greenville, S. C.*, H. R. Fothergill, *General Manager.*

About 45 degrees.
—*Toronto Railway Co., Toronto, Ont.*, W. R. McRae, *Master Mechanic.*

Mr. Corning:—I would like to ask what the practice is on some of the roads as to the disposition of lightning arresters along the line—whether there is any generally adopted plan of placing them at certain definite intervals.

Vice-President Simmons:—I might say in reply to the question asked that our road endeavors to place lightning arresters at least every half mile on all our interurban lines.

Mr. Mitchel:—I would say, Mr. President, that we place lightning arresters in deep railroad cuts and on high spots as we have found these spots most liable to lightning.

Mr. Roberts:— It is our practice, Mr. President, to cluster lightning arresters on high spots and to cluster them very thickly around the power house. On every pole around one power house at Cuyahoga Falls that is particularly susceptible to lightning, I have placed 24 lightning arresters. I am not here to advertise any particular make of lightning arrester, but we have used very extensively during this last summer quite a number of a new type of lightning arrester. Last year we lost 38 armatures on our high speed cars between Akron and Cleveland. This year we have only lost three, and I believe that favorable result has been largely owing to the fact of our adopting this new type of lightning arrester and grouping them around the power house. We have had only two hard shocks in the power house during the entire year, and at our large central station in Akron, where we operate both the high and low tension — d.c. and a.c.— from 600 volts d.c. to 22,000 volts a.c. on high tension transmission lines, and where we have grouped together turbine installation and high tension and d.c. low tension, only once this year have we been seriously troubled with lightning, and the storm was so heavy on that occasion, and the lightning so concentrated around the city that I thought it better as a matter of precaution to shut down the whole station. We had seven shocks, three on the d.c. end and four on the a.c. end. One came in on the 22,000 volt transmission line, and burned about 4 feet out of one of the 3-phase wires. That happened just as I was making my way down from the office. I will never forget the sight that presented itself to me from the glass doors of the switchboard room. I thought it was just one small glimpse of hell, just a blaze of fire. I couldn't see anything. When I got in, the first thing I heard was "The big transformers are gone." I said, "Not on your life!" "Throw everything out!" "Make yourselves busy now, and get that wire spliced up. We want to go in in a few minutes." I just held her down. I went down to the d.c. board, stood there a few moments, turned to one of the switchboard attendants and I said, "We will take chances in starting up the 1,000 kw. d.c. engine." Of course, we had all the engines turning but not in operation on the electrical end. I then said, "Just a moment." Immediately we got three shocks in on the d.c. side. Two of them came in over these lightning arresters, and they took care of every shock. I walked along to the a.c. board on the high tension side, and I stood just under the glass tube, and we got a static discharge there; and if the dynamic had followed it we would not have had any power house. I just waited a few moments, went out to the north end of the building, looked out and came back again, and said, "Just get her moving, boys, but don't get anything in." About five minutes after that we had another shock that I believe would have put us out of business altogether, but presently the center seemed to move further toward the east, and we started up. We were shut down 25 minutes, the first time we have had to shut down for lightning trouble for quite a long time. I think it was a very good thing to do, for unquestionably in my mind we would have had some serious trouble in the power house. As it was, the trouble was simply confined to the destruction of this wire and the burning away of about four feet of copper on the No. 2 wire on the high transmission line. I simply wished to impress that fact upon you, Mr. President, because I have so frequently read of the disposition of lightning arresters, and in all the literature I have read on the subject, and very interestingly written, too — as a matter of study, not a cursory examination, but for my own direction,— I have never found any definite statement made of the best place to locate lightning arresters. The fact that our trouble has been decreased from a loss, as I have said, of a large number of armatures, I think it was 36, although I am not quite sure, and that this year we have lost only two, and possibly three,— it may be three, but possibly not more than two — I attribute entirely to the fact of the placing of the lightning arresters around the power house, and also to this fact, that on one of our long distance lines we have a station storage battery and on the other a line battery. They are the best lightning arresters in the world. But I have stood in Bedford, about 18 miles from this Cuyahoga Falls power house and seen a shot come in twelve miles, up to the power house at Bedford, go through the power house and through the storage battery, and no harm done. But that came in from a place called County Line, and at that very county line I think we have had most of our trouble through static discharge and the dynamic following it. Of course, we would have no trouble from a lightning discharge if the static did not make a path for the dynamic. I would advise any gentlemen who are up against this proposition to investigate on these lines and find out where your trouble starts, and then it is a very easy matter to determine, and group your lightning arresters. Do not be afraid of spending money on lightning arresters, but put them thickly around the power house.

MR. MITCHEL:— I want to say, Mr. President, on that same line, that we adopted some years ago — and although not entirely systematically, but we have been getting closer to it — the keeping of a map and noting every time we have a lightning storm, about where the lightning strikes cars or line. We find that certain spots are more liable to it than others, and we put lightning arresters there, and in that way have cut down losses greatly. We have very few losses at present.

VICE-PRESIDENT SIMMONS:— It is just after 5 o'clock, the time at which we are scheduled to disperse, and if there are no further questions we will adjourn.

We adjourn, gentlemen, to meet with the main association to-morrow morning at Casino Hall over the entrance to this pier. This association will reconvene at 2 o'clock to-morrow afternoon to take up several important papers.

## WEDNESDAY AFTERNOON SESSION

### OCTOBER 16, 1907.

Vice-President Simmons called the meeting to order at 3:15 o'clock.

VICE-PRESIDENT SIMMONS:—The meeting will please come to order. The first item on the program for this afternoon is the paper entitled "A Year's Experience with Gas Engines," by Paul Winsor, Chief Engineer, Motive Power and Rolling Stock, Boston Elevated Railway Company. Mr. Winsor, unfortunately, could not attend the meeting, and Mr. Charles Hewitt of Philadelphia will be kind enough to read the paper to us. It is a short paper, and I think we will have it read through.

Mr Hewitt read the paper.

## A YEAR'S EXPERIENCE WITH GAS ENGINES.

BY PAUL WINSOR, *Chief Engineer Motive Power and Rolling Stock,*
Boston Elevated Railway Co., Boston, Mass.

We have now been operating our gas-engine plants over a year and the following statement of the results may be of interest to some of you.

We have two of these plants, both of them generating direct current and feeding into our overhead system in multiple with our steam-driven power stations. They have been operated most of the time by two 8-hour watches from 7:00 A. M. to 11:00 P. M. and shut down from 11:00 P. M. to 7:00 A. M. The following figures and statements apply to our Somerville Power Station. I give no figures for our other plant as it has not yet been accepted.

The Somerville Power Station has the following equipment:

One paid of Loomis-Pettibone gas producers, with the usual auxiliaries.
Two 600 brake h.p. Crossley gas-engines, each 2-cylinder, 4-cycle.
Two 350 kw. Crocker-Wheeler generators — d.c.

This plant was started in May, 1906, and since then has given continuous, reliable and satisfactory service. There have been no shutdowns, no accidents and no failures.

The fuel has been soft coal, the same as used in our steam stations, mostly run-of-mine Pocahontas. The economic results are shown in the following tables:

|  | SOMERVILLE POWER STATION BOSTON ELEVATED RAILWAY COMPANY, JANUARY, 1907, TO AUGUST, 1907. |  |  |  |  |  |  | Total. | Average. |
|---|---|---|---|---|---|---|---|---|---|
|  | Jan. | Feb. | March. | April. | May. | June. | July. |  |  |
| Kilowatt hours generated | 204,080 | 175,200 | 192,250 | 202,870 | 118,640 | 35,770 | 60,170 | 988,980 | ......... |
| Total lb. coal, including coke | 391,223 | 364,817 | 405,050 | 401,150 | 234,705 | 90,991 | 124,452 | 2,012,388 | ......... |
| Lb. coal per kilowatt hour | 1.917 | 2.081 | 2.120 | 1.975 | 1.979 | 2.542 | 2.065 | ........ | 2.034 |
| Lb. coal per b. h. p. hour | 1.322 | 1.436 | 1.462 | 1.363 | 1.365 | 1.755 | 1.425 | ........ | 1.404 |
| Station load factor based on 16 hrs per day and 7 days per week | 58.8% | 55.9% | 55.3% | 60.4% | 34.2% | 10.6% | 17.3% | ........ | 41.6% |
| Engine load factor | 84.1% | 86.0% | 87.4% | 82.3% | 78.3% | 73.3% | 82.8% | ........ | 83.2% |
| Generator load factor | 99.3% | 101.3% | 103.0% | 97.1% | 92.4% | 86.5% | 97.7% | ........ | 98.35% |

These are the results from actual service and include all the fuel used for power, heating, etc., and the auditor's usual 1 per cent. to make his books balance.

A year ago I told you that we were operating on 1.45-lb. per kw-hr. Later, before the Proceedings were published, I had to withdraw that figure. Overzealousness on the part of the producer men working for the contractors led them to use coal that had not been weighed, and lack of proper checking on the part of our men failed to catch them at it, and it was not until we took account of coal on hand that we discovered what had been going on.

The following are some of the points that have particularly interested us:

### WATER.

We have used a great deal of water for scrubbing the gas and for cooling purposes. The average amount has been 281-lb. per kilowatt-hour. When we bought this water, as we did for a few months, our water cost about twice as much as our coal. We have been, since November 21, 1906, pumping this from a very dirty brook by means of 2-stage centrifugal pumps, electric driven, and filtering through a pressure sand filter. This outfit has been entirely satisfactory and has given us no trouble. The suction lift is 12-ft. and the pressure at the pumps 30-lb.

The discharge of water from the gas scrubbers is very dirty, being full of floating lampblack, and is altogether too black to put back into our dirty brook. A sand filter basin 246⅔ square feet in area and tile under-drained, removes all the lampblack, so that we are turning back into the brook cleaner water than we take out.

### IGNITION.

Our ignition current is from 14-volt motor generators and a floating storage battery and we have no trouble with the outfit. The igniters are make-and-break, two to each cylinder. These igniters had originally platinum tips, which cost a great deal and gave considerable trouble. We have been running now four months without any platinum and with less trouble.

### BACK FIRES AND PRE-IGNITIONS.

During the first months, back fires and pre-ignitions were much too frequent, occurring almost every day. Lowering the compression on one of the cylinders, changes in the igniters, and experience have reduced these troubles, so that we now go two or three weeks without a single one.

### RELIABILITY.

This plant has proved absolutely reliable. It can be put into service any time in less than five minutes — much quicker than can our steam plants. It can carry good loads and do it continuously. Each unit has carried 450 kilowatts (652 brake horse power) for an hour, with swings to 495 kilowatts (717 brake horse power).

### EFFICIENCY.

For the first seven months of this year this plant used 2.034-lb. coal per kw-hour, while our steam plants averaged 3.477-lb. per kw-hour — a saving of 41.5 per cent. One of our smaller steam plants, containing three 200-kw. compound condensing engines, used 4.414-lb. per kw-hour; this gas station used only 46.1 per cent. as much.

### CONCLUSION.

Personally, I believe that a gas-engine plant, making its own producer gas, will operate at least as reliably as a steam plant and will use from 30 to 60 per cent. less fuel, depending somewhat on the size of the gas plant, but principally on the size of the steam plant.

The drawbacks to the gas plant are, in my mind:

1st. Cost, approximating $200 per kw. when rated so as to have a 33⅓ per cent. overload capacity.
2nd. Small size of units — the largest gas-engine now built being of but about 3,000-kw. capacity.

Below, marked "A" and "B," are copies of reports, which summarize the log sheets of the Somerville Power Station for the weeks ending July 27, 1907, and August 3, 1907, respectively:

### (*A*) — *Week Ending July* 27, 1907.

With the exception of the following incidents, the operation of the plant during the past seven days has been satisfactory.

| Engine | Back fires. | Pre-ignitions. | Inter-ruptions. |
|---|---|---|---|
| No. 1 | 0 | 0 | 0 |
| No. 2 | 0 | 0 | 0 |

*July* 22.
Renewed No. 1 engine "A" and "B" upper igniters—general repairs..
*July* 25.
Renewed No. 1 engine "A" lower igniter—general repairs.
Repaired contacts on No. 1 engine, "B" lower igniter.
B. E. Ry. men finished rewinding No. 2 armature on July 20 and generator was put in service July 27, 1907.

Cubic feet of city water has been used as follows:

| *Small meter. | Remarks. | Large meter. | Remarks. |
|---|---|---|---|
| July 21 570 | | 670 | Low tide. |
| July 22, 1,180 | | 590 | Low tide. |
| July 23, 1,050 | | 0 | |
| July 24, 880 | | 0 | |
| July 25, 1,110 | | 0 | |
| July 26, 920 | | 0 | |
| July 27, 630 | | 0 | |

*Feed water for economizer boiler.

### (*B*) — *Week ending August* 3, 1907.

With the exception of the following incidents, the operation of the plant during the past 7 days has been satisfactory.

| Engine. | Back fires. | Pre-ignitions | Interruptions. |
|---|---|---|---|
| No. 1 | 6 | 8 | 0 |
| No. 2 | 0 | 0 | 0 |

Pre-ignitions and back fires were due to carbonized oil in No. 1 A cylinder, July 28 and 29.

*Aug.* 1.
Repaired contacts on No. 1 engine, "A" upper igniter.

*Aug.* 2.
Repaired contacts on No. 2 engine "A" and "B" upper igniters.
Cleared ground and repaired contacts on No. 2 engine "B" lower igniter.

Cubic feet of city water has been used as follows:

| *Small meter. | Remarks. | Large meter. | Remarks. |
|---|---|---|---|
| July 28, 940 | | 0 | |
| July 29, 610 | | 0 | |
| July 30, 580 | | 0 | |
| July 31, 810 | | 0 | |
| Aug. 1, 510 | | 0 | |
| Aug. 2, 910 | | 0 | |
| Aug. 3, 680 | | 0 | |

* Feed water for economizer boiler.

VICE-PRESIDENT SIMMONS:— Gentlemen, Mr. Winsor's paper is now before you for discussion.

### *Discussion of Mr. Winsor's Paper.*

MR. PALMER:— I would like to inquire if this figure of 3.477 lb. of coal per kw-hr. is the average of all the Boston Elevated steam plant consumption?

VICE-PRESIDENT SIMMONS:— Some one from the Boston Company can probably answer that question.

MR. CORNING:— This is the average for all our steam plants.

MR. PALMER:— I would like to ask, Mr. Chairman, if any comparisons are available between the total cost of power per kw-hr. delivered from this gas plant, and from the steam plants, including supplies, repairs, etc.

MR. CORNING:— Undoubtedly there are figures of that sort, but whether they are available at the present time or not, I am unable to say.

MR. BIBBINS:— It is of interest in connection with this paper to note that the economies quoted may be confirmed by similar results obtained from other plants which I have in mind. One of these is the Norton Company, Worcester, Mass., a 500 h.p. equipment of the horizontal, double acting type, with intermittent bituminous producers. This plant operates only ten hours a day and on the usual shop motor load, yet it averages 2 lb. of coal per kw-hr., with an average engine loading factor of 73 per cent., about 10 per cent. less than the average loading Mr. Winsor cites for the Somerville station. Further, on continous full load, this plant has shown an average coal consumption of less than 1.5 lb. per kw-hr., or practically 1 lb. per b.h.p.hr.

The Gould Coupler plant at Depew, N. Y., equipped with 3-cylinder vertical units, continues to show its old-time economy, averaging about 1.8 lb. per kw-hr. at a loading of 80 per cent. to 90 per cent. rating.

Another 500 h.p. plant recently tested at The American Locomotive Works, Richmond, Va., shows an even lower economy on regular shop load. This plant is also equipped with a horizontal, double acting type gas engine and bituminous producers.

VICE-PRESIDENT SIMMONS:— We will now have a paper on "Some Practical Points in Steam Turbine Construction," by Mr. St. John Chilton, Engineer Allis-Chalmers Co., Milwaukee, Wis.

# SOME PRACTICAL POINTS IN STEAM TURBINE CONSTRUCTION;

## WITH PARTICULAR REFERENCE TO THE PARSONS TYPE.

BY ST. JOHN CHILTON, *Engineer,*
Allis-Chalmers Co., Milwaukee, Wis.

The greater part of what has been written of the principles governing steam turbine design deals with theoretical considerations that must be left to the experience and judgment of the manufacturer, and are, therefore, of particular interest only to the designer and specialist. The interest of the power plant engineer lies in the results obtained, nevertheless there are practical considerations of interest indicating results that may be expected from turbines having stated characteristics, and that may be of assistance in fixing operating conditions. In this paper an effort will be made to bring these out.

Steam turbines are divided into two general types, best known as impulse and reaction. In an impulse turbine steam is first expanded in a nozzle or nozzles, in which it acquires a velocity depending, within certain limits, upon the fall in pressure. It is then allowed to impinge upon buckets suitably fastened to the periphery of a disc, and they, in turn, abstract the velocity, thereby imparting rotation to the shaft to which the disc is fixed. No fall in pressure occurs within these rotating buckets; the rotative effort, therefore, is due wholly to the velocity imparted to the steam within the nozzles. When more than one ring of rotating buckets is used to abstract the velocity from a single nozzle, or single group of nozzles, the flow of steam, with little or no further expansion, is reversed by stationary buckets which guide it into a second ring of rotating buckets. Fig. 1 shows relative positions of nozzles, stationary and rotating buckets, and the direction of flow of steam through them.

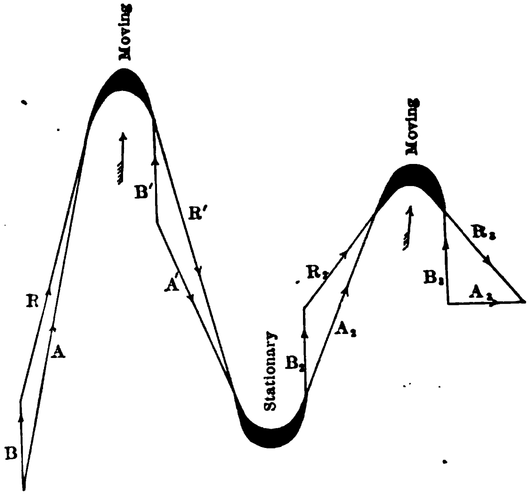


Fig. 1.—Relative Positions of Impulse-Buckets and the Direction of Flow of Steam.

The quantity of steam delivered to the buckets is regulated by varying the number of nozzles in action and the quantity of steam supplied to individual nozzles.

The velocity of flow through the buckets, in this type of turbine, can be reduced by increasing the number of re-expansions, or stages, a stage being defined as the elements required to develop and to abstract the velocity due to a single-pressure drop; that is, a set of expansion nozzles, with the necessary number of rings of rotating and stationary buckets.

Various applications of the impluse principle are found in turbines of different manufacturers; but in all of this type, velocity is first imparted to the steam and then abstracted by the rotating element without having additional velocity imparted to the steam.

Only a part of the periphery of a disc is active at any instant unless multiple-stage construction is used; then the proportion of active buckets increases with the increasing volume of steam, until, in the last stage, all the buckets may be active.

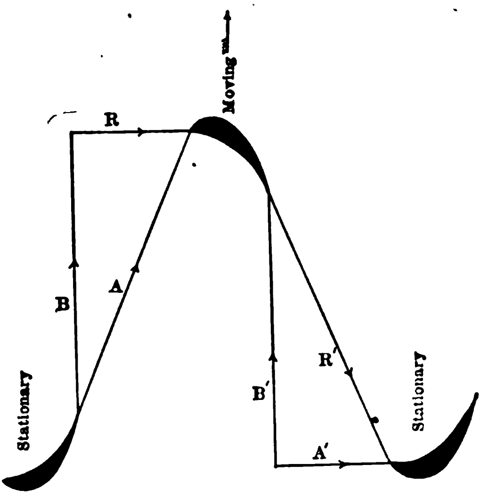


FIG. 2.— RELATIVE POSITIONS OF REACTION BLADES AND THE DIRECTION OF FLOW OF STEAM.

The reaction, or Parsons, type has no expansion-nozzles, as ordinarily understood, but is provided with alternate rows of stationary and rotating blades. Steam is admitted to the first row of stationary blades, then passes through the length of the turbine, falling in pressure and increasing in volume until the exhaust-opening is reached. Expansion occurs in both the stationary and rotating rings of blades, and the velocity thus required is abstracted by the rotating element; the velocity acquired in the stationary blades being abstracted by impulse action, and that acquired in the rotating blades, by reaction.

Fig. 2 shows the relative positions of stationary and rotating blades, with the direction of flow of steam through them.

The cross sectional area of the steam passages through the blades, is increased from the high to the low-pressure end of the turbine, to correspond with the increase in volume of steam. Where this requirement necessitates blades of too great a length, the diameter of the rotor, or spindle, is increased. (See Fig. 3.) This admits of a greater number of blades per ring, hence an increased number of openings between blades, thereby permitting of the retention of the blade-lengths within limits mechanically practical. Blades of different lengths are so grouped, with reference to the fall in steam pressure, as to maintain a substantially-constant velocity-ratio.

In the Parsons-type turbine the entire annular space between rotor and cylinder is filled with working steam, and all the blades are active, thus eliminating useless friction, due to idle rotating parts.

The work developed in turbine blades depends upon the quantity of steam supplied and its velocity, and not upon pressures and pressure-areas, as in steam engines, therefore the widths of the blades can be so proportioned to the lengths as to insure necessary strength and stiffness, and, thus, amply meet all mechanical requirements.

As has been already stated, expansion takes place in both stationary and rotating blades of the Parsons-type turbine. Each pair of blade-rings, consisting of one stationary and one rotating ring, may, therefore, be considered as corresponding to a stage in the impulse-type. The reaction turbine has, accordingly, many stages when compared with the impulse-type, and the velocity of steam is thus much lower. Theoretically, the ratio of steam-velocity to blade, or bucket-velocity, required to obtain the most economical results, approximates two to one. Hence, the peripheral velocity of the rotating element in a reaction-turbine, with its many stages, is generally much lower than in the impulse-type, with its few stages.

Since the peripheral velocity of the rotating element required, depends solely upon the velocity of the steam, and is independent of the speed of the turbine, the rotor diameter must be correspondingly increased when the speed is reduced. Lower speed, therefore, does not necessarily mean lower blade velocity; in fact, the highest peripheral velocity of blades in a reaction-turbine is generally below that in impulse-turbines, running at even much lower speed. Another disadvantage of high steam-velocity, is that the erosive effect of steam increases directly with the square of its velocity.

In reciprocating engine practice it has been customary to compare the weights of engines as an indication of relative strength and rigidity. Even with this prime mover, such comparisons are often unreliable unless distribution of weight is also considered. In steam turbines there are no reciprocating motion strains to be considered, and the most important factors are of a nature distinct from those governing reciprocating-engine design. For instance, the rotor-diameter, and, therefore, the cylinder-diameter, is changed for different speeds. The weight depends chiefly upon the diameter of these parts, and, furthermore, to remove all weight that does not contribute to its strength, considerable additional expense is incurred in the construction of the rotor. Indeed, so many things have to be taken into consideration if weights of steam turbines be compared, that any such comparison is misleading, even in turbines of the same type. Owing to difference in construction, no comparison is possible between turbines of different types.

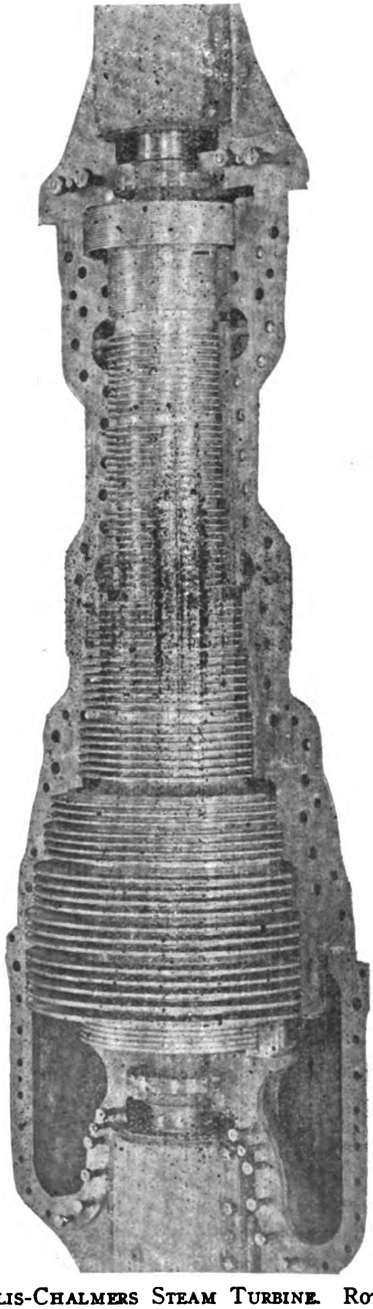


FIG. 3.—ALLIS-CHALMERS STEAM TURBINE. ROTOR AND HALF CYLINDER SHOWING BLADING AND BALANCE-PISTONS.

Both types of steam turbines are essentially high speed, and the tendency is toward increasing the speeds that were accepted standards a few years ago. Higher speed means increased economy of operation, and experience has shown this speed advance to be practical mechanically up to the limits set by the generators to which the turbines are connected. Appreciating this, some manufacturers are voluntarily incurring the expense of developing new standards.

Each type of turbine had its inherent difficulties to be overcome before the requirements of commercial operation could be met satisfactorily. In the reaction, or Parsons-type, an important source of loss in efficiency is the steam leaking past the ends of the blades without doing work. It is desirable, therefore, to reduce this loss to a minimum. The quantity of steam thus lost past a ring of blades, depends upon the peripheral length of the ring, the percentage that the clearance is of the length of blades in the ring, and the clearance at the ends of the blades. Obviously, then, leakage will be greatest over the shortest blades. The effect of speed upon economy, here, is self-evident. Increase of speed and consequent decrease in rotor- and cylinder-diameters reduces the peripheral length of the rings, and, by increasing the blade-lengths, reduces the percentage that the clearance is of the lengths of the blades; this clearance remains practically constant. It is also evident that economy demands the smallest possible radial clearance consistent with safety. In reaction-turbines small clearances between stationary and rotating blades, in line with the flow of steam, are unnecessary, and in practice the clearance is never less than ⅛-in. between the smallest blades, and often as much as 0.75-in. between the largest blades, thereby allowing ample room for difference in expansion of rotor and cylinder.

Necessity for small radial clearance soon demonstrated the advisability of protecting the tips of the blades to prevent them from being knocked out through accidental contact with cylinder or rotor. Many interesting patents, in fact, endeavoring to accomplish this, have been taken out by manufacturers of this type of turbine. The one that experience has proved both practical and effective is seen in the blading construction in Fig. 3, and more in detail in Figs. 4, 5, and 6. In this construction the blades are cut from drawn stock and each blade is formed by special machine tools so that at its root it is of angular dovetail shape, while at its tip there is a projection. To hold the roots of the blades firmly, a foundation-ring is provided. (A in Fig. 4.) This foundation-ring is first formed to a circle of the proper diameter, and then slots are cut in it by a special milling machine, and these, accurately spaced and inclined to give the required pitch and angle to the blades (see Fig. 5), are of dovetail shape to receive the roots of the blades. The tips of the blades are substantially bound together and protected by means of a channel-shaped shroud-ring (B, Fig. 4), in which are holes punched to receive the projections on the tips of the blades. Accurately spaced by a special machine, these holes match the slots in the foundation ring.

The foundation rings themselves are of dovetail shape in cross section, and, after receiving the roots of the blades, are inserted in dovetailed grooves in the cylinder and rotor where they are firmly held in place by key-pieces. (C, Fig. 4.) Each key piece when driven in place, is upset into an undercut groove, (D, Fig. 4), thereby locking the whole structure together.

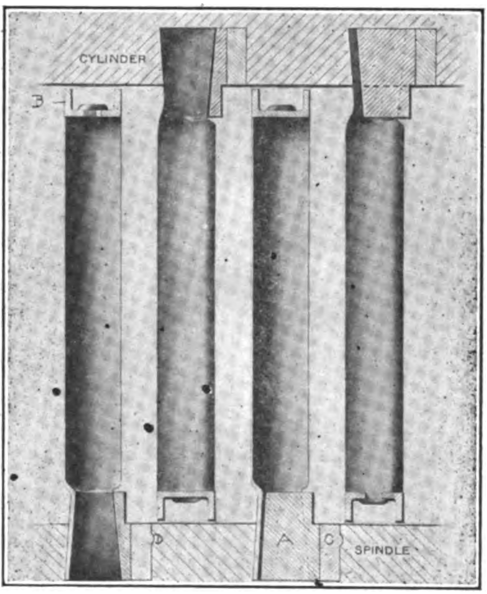


FIG. 4.—ALLIS-CHALMERS STEAM TURBINE BLADING.

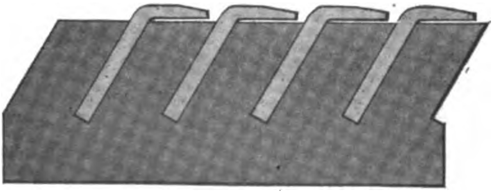


FIG 5.—SECTION OF FOUNDATION—RING SHOWING ROOTS OF BLADES INSERTED.

After being inserted in the turbine, as above described, each blade is so firmly held between the bottom of the slot in the foundation-ring and the side of the groove, owing to the dovetailed shape of its root, that it is impossible for a blade to get out of place.

The flanges of the channel-shaped shroud-rings are purposely made thin, so that, in case of accidental contact between revolving and stationary parts, they will wear away enough to prevent the blades from being ripped out. This protection is such that to rip them out a whole ring of blades must be sheared off at the roots. The strength of the blading, therefore, depends not upon the strength of an individual blade, but upon the combined shearing strength of an entire ring of blades.

The blading is made up in half rings, and the photograph (Fig. 6) shows two of these ready to be put in place in a turbine. These rings are a thorough machine shop job, easily inspected, with the uncertainty of hand-work eliminated.

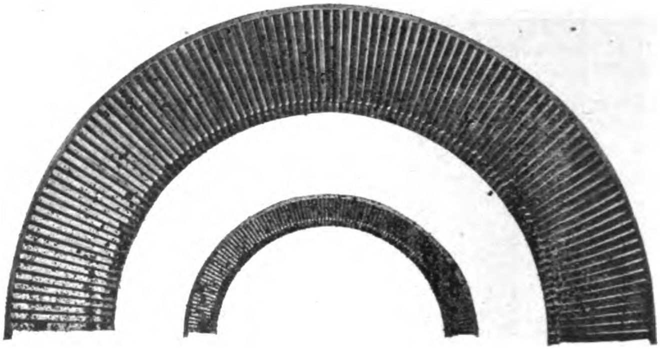


FIG. 6.—HALF-RINGS OF ALLIS-CHALMERS BLADING READY FOR INSERTION IN TURBINE.

No matter what precautions are taken to prevent trouble, it is generally appreciated that the possibility of defective material creeping in, makes easy facilities for repairs advisable. With the construction described, any blading trouble would be localized and damaged rings could be removed and the turbine continued in operation until such rings could be replaced conveniently. These half rings can be inserted quickly and without disturbing the thrust-balance of the rotor.

The improvements effected by this construction may be summed up as follows:

1. Firm attachment of blades.
2. Ample stiffening of blades of all lengths against effects of vibration.
3. Accurate spacing and accurate angles of blades.
4. Protection of blade-tips, so that accidental contact will not rip out blades.
5. Smaller clearance, resulting in diminished steam-leakage and, hence, increased economy.
6. Improved baffling against steam-leakage by reason of the shape of the shroud-ring.
7. Protection against a possibly defective blade coming out and destroying other blades.

8. Accurate machine-work, as against uncertain hand-work.
9. The facility for thorough inspection of workmanship.
10. The localizing of any possible trouble and the convenience of making quick repairs.

Another difficulty that, in the past, caused some trouble, was due to the method used to balance the thrust along the rotor, resulting from the drop in pressure in the rotating blades of the reaction-turbine. Balance-pistons, connected with several points in the turbine cylinder, by means of equalizing passages, are used for this purpose. These balance-pistons (marked L.M.N.) are shown in Fig. 7. The earlier construction was to place the three balance-pistons upon the high-pressure end of the turbine rotor, as shown in Fig. 7. No trouble was experienced from this arrangement except with the largest, or low pressure, piston. In the larger turbines, this became of considerable diameter, and, owing to the necessity of constructing it with a web, showed a tendency to warp, thereby bringing in contact the dummy-rings in the periphery of the piston with those in the cylinder. These dummy-rings serve as baffles to prevent steam-leakage past the pistons, and their contact at high velocity meant not only their own destruction, but also injury or destruction to the surrounding parts. A simple but effective means of eliminating this trouble is shown in Fig. 3. The two smaller balance-pistons, easily made sufficiently stiff to prevent warping under any conditions of operation, are allowed to remain upon the high-pressure end, but the largest piston is placed upon the low-pressure end of the rotor, immediately behind the last ring of blades. In this location its effective area starts from a smaller inner diameter, hence the required area can be obtained with a smaller outer diameter. It can be also constructed as part of the rotor, and, therefore, has ample stiffness to prevent warping. It receives its steam pressure from the same point in the turbine as the largest piston shown in Fig. 7, which it replaces; but the steam-passage is through holes in the webs

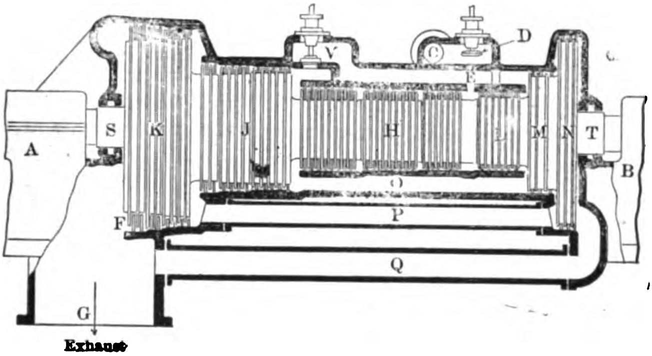


Fig. 7.—Elementary Parsons-Type Steam Turbine.

of the blade carrying-rings, which are pressed on the rotor to obtain the largest diameter shown in Fig. 3. Entrance to these holes is through the small annular opening in the rotor, visible in Fig. 3, between the second and third barrels.

As the area of these balance-pistons cannot be changed without replacement, and as it is not advisable to change the blade-angles after the blades have been correctly set in place, doubt may arise as to the possibility of calculating the thrust with sufficient accuracy to obtain perfect thrust-balance. From the construction of the blading, the accuracy of the blade-spacing and blade-angles can be depended upon. It remains, then, only to determine, by calculation, the pressures at the various points in the turbine. It is therefore interesting to note that repeated tests have shown the pressures at different points in turbines having correct blade-spacing and angles, to be within one per cent. of the calculated pressures.

For new installations, inquiry is often made as to the steam pressure best suited to turbines. Taking everything into consideration, it seems probable that the most economical operating pressure will be found at about 150 lb. above atmospheric pressure at the throttle valve, and that a greater saving can be effected by the use of a small amount of superheat than by increasing the initial pressure beyond this point. Reliable data shows the gain in steam economy, by increasing the pressure from 150 to 175 lb., to be approximately two per cent.; an increase of pressure from 150 to 200 lb. improves the steam economy by approximately three per cent. Against this should be placed the increased cost of piping, valves and boilers, and the loss due to increased leakage. The selection of the most economical steam pressure, therefore, resolves itself into a comparison of the cost of fuel and initial investment that ought to be made for definite conditions. Increasing the steam pressure also has a tendency to add to, rather than reduce, the cost of the turbine.

Since steam turbines have become better known, the impression is not so common, that higher vacuum is required to obtain economical results with this prime mover than with reciprocating engines. Higher vacuum is not required to obtain good results; but as turbines are not subjected to the changes in temperature, present in the cylinders of reciprocating engines, they can utilize high vacuum to better advantage. The difference in steam economy, within the range between six inches and three inches absolute, is, approximately, five per cent. per inch. The saving effected between three and two inches is approximately six per cent., and between two inches and one inch approximately seven per cent. An idea of the relative quantity of condensing water required for different vacuums may be gained by comparing that required for the usual operating vacuums. For example: with injection water of 70° F., the usual temperature upon which condenser guarantees are based, it is customary to figure upon using about 36 lb. water per pound of steam condensed, to obtain a vacuum of 3 inches absolute, and about

1.4 times this quantity is required for a vacuum of two inches absolute. With injection water of 60° F., which may be considered the winter temperature, the quantities required for the foregoing vacuums are approximately 28 and 34 lb. respectively. Having the quantity of condensing water required, the cost of fuel, and cost of water delivered to the condenser, the vacuum best suited to the conditions under consideration may be determined. Theoretically, the effect upon the turbine of reducing the vacuum below that for which it is designed, is to reduce the capacity and to lower the rating at which maximum economy is obtained. Turbines, however, are designed with sufficient flexibility to allow of varying operating conditions within wide limits, hence the theoretical reduction in capacity is not one that need be considered unless an unusual reduction in vacuum is contemplated. In the reaction-turbine, for a given initial pressure, lower operating vacuum permits of fewer rings of blades; likewise a smaller area of exhaust-opening. Therefore, the effect upon the cost of the turbine is to reduce rather than increase it; the difference, however, is not sufficient to be of importance in determining the operating vacuum desirable.

Although much remains to be determined concerning super-heated steam, experience has shown that, in turbine plants, a substantial saving in fuel can be effected by its use. Steam consumption tests show that the increment of saving becomes smaller as the super-heat is increased. For 50° F. superheat at the turbine throttle, a reduction in steam consumption is effected, approximating 7 per cent. The reduction for 100° F. approximates 10 per cent. and for 150° F., 12.5 per cent. This saving is due, in part, to the maintenance of drier steam, and to a reduction of skin-friction upon the blades. As superheat reduces the weight of steam required per unit of power developed, its effect upon a turbine designed for dry saturated steam would be to increase its capacity unless it caused a corresponding increase in volume. The increase in volume, however, is sufficient to maintain the capacity of the turbine practically unchanged.

The Parsons-type turbine is too well known to require detailed description. However, the important position occupied by steam turbines in power-plant work insures interest in marked improvements in details of their construction. The turbines shown in Figs. 3 and 8 have several besides those already described and among them may be mentioned the governor-mechanism. This is of the hydraulic type, and the governor is required to operate the small, balanced oil relay-valve only, while the two steam valves, main and by-pass, are controlled by a strong force due to oil pressure of about 20 lb. per sq. in., acting upon a piston of suitable size. As a turbine by-pass valve opens only when the turbine is required to develop overload or the vacuum fails, a good feature of this governor-mechanism is that this valve can be kept constantly in motion, thereby preventing sticking even if called into action only at long intervals. Another feature of importance is that the oil supply to the bearings, and that to the governor, can be

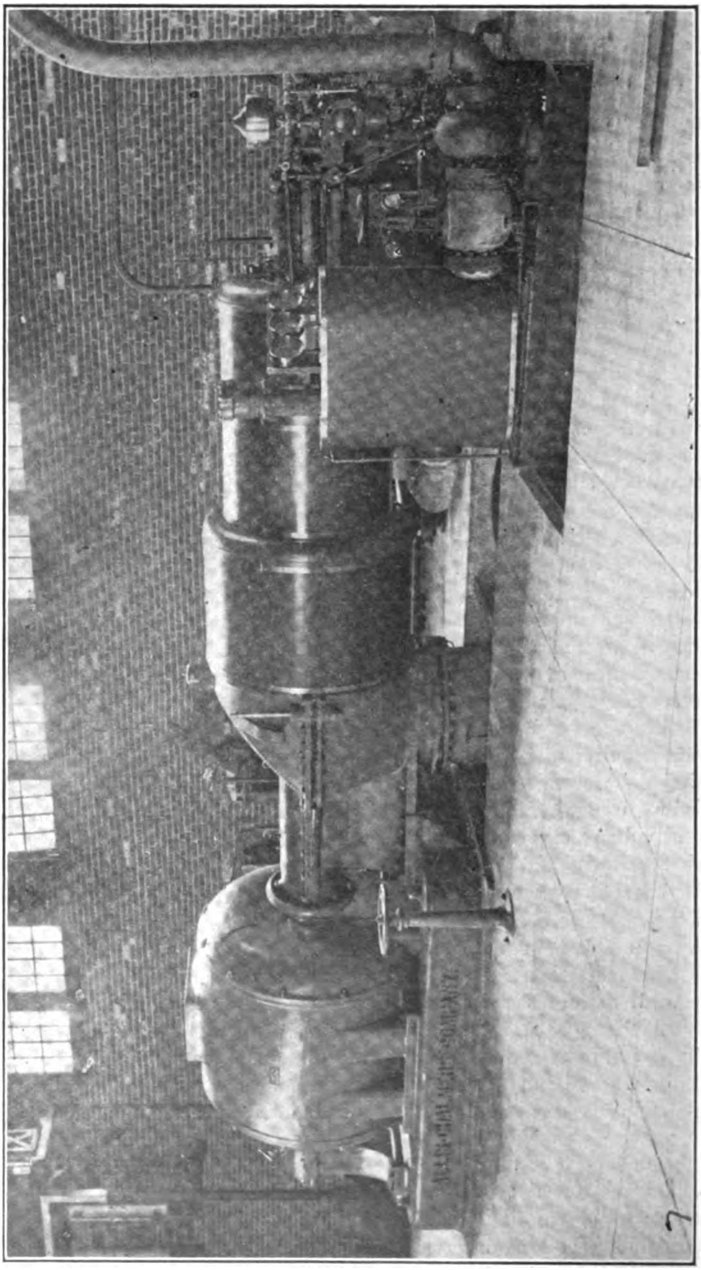


Fig. 8.— 1,000 kw., 1,800 r. p. m., 60-Cycle, Allis-Chalmers Parsons Steam Turbine and Alternator.

inter-connected so that the governor will shut off the steam if the oil supply fails.

The speed at which turbo-generators must operate necessitates mechanical construction different from that found satisfactory in other classes of electric generators, and also more expensive. Owing to the compactness of these generators, however, and to the small number of poles, better electrical efficiencies can be obtained.

The high peripheral velocity necessitates the use of stronger material in the rotating parts, and special provisions must be made for holding the field windings firmly in place and for protecting the insulation. Special attention is given these requirements in the generator shown in Fig. 8, and one of the interesting features of its rotor is that the winding is placed in radial slots to prevent rubbing between adjacent conductors, that might cause injury to the insulation. The generator referred to is totally enclosed to insure noiseless operation, and forced ventilation is provided by having a small fan on each end of the rotor. If desired, the air inlets can be piped through the basement to the outside of the building and a lower operating temperature thus obtained.

An interesting application of this prime mover is the use of low pressure turbines to operate with exhaust steam from reciprocating engines. The capacity of plants equipped with non-condensing reciprocating engines can be advantageously increased in this way. The exhaust steam from a cross-compound non-condensing engine is sufficient to develop, in a low pressure turbine, power equivalent to approximately 70 per cent. of that developed in the engine, and the steam consumption of such a turbine, operating with a vacuum of 27 inches referred to 30 inches barometer, would be approximately 2.25 times that of a high pressure turbine exhausting into the same vacuum and supplied with the usual initial steam pressure.

VICE-PRESIDENT SIMMONS:—Gentlemen, you have heard the reading of this very interesting paper by Mr. Chilton. I assume that Mr. Chilton stands ready to answer any questions which you may have to present. We have for presentation papers on two other types of turbine construction, and we would be glad to hear anything that may be offered on the paper just read. If no gentleman has anything that he wants to take up, we will proceed with the next paper on the program, "Curtis Turbines in Railway Service," by Mr. August H. Kruesi.

Mr. Kruesi read his paper.

# CURTIS TURBINES IN RAILWAY SERVICE.

By August H. Kruesi, *Engineer,*

General Electric Company, Schenectady, N. Y.

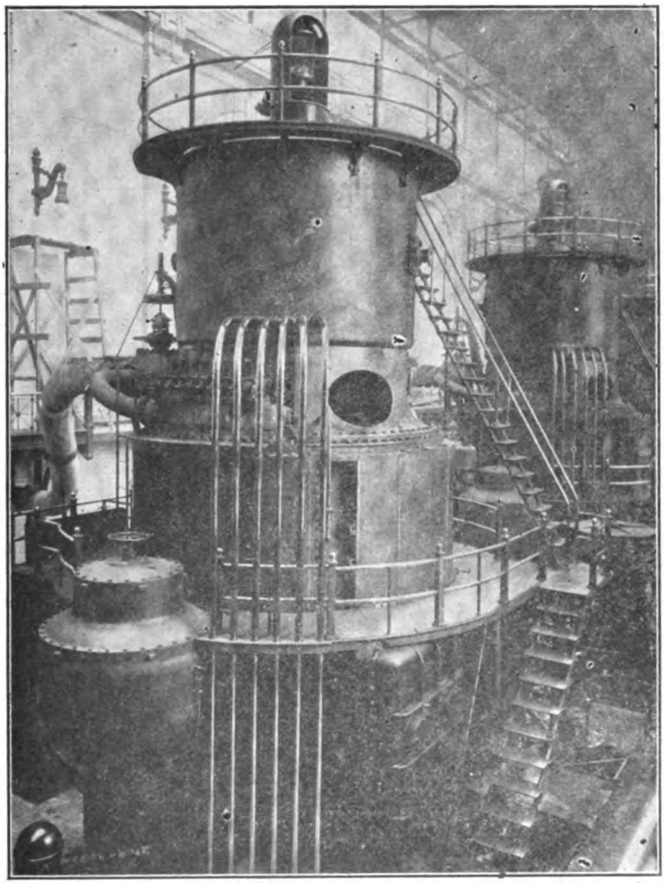
Less than fifteen years ago the severity of street railway loads called forth much discussion as to the design of steam-engines for this work, the loads being compared to those arising in rolling mill service. To-day we have to deal with a repetition of loads of the same nature as regards variability in connection with interurban and heavy traction systems operating small numbers of heavy cars on infrequent headway, but engines have been all but superseded, in new plants, by steam turbines which are so peculiarly adapted to these requirements that their behavior has called forth little or no discussion with reference to variation in load. Nowadays discussion of power house operation generally deals with the behavior of the newer types of apparatus which the turbine has called into existence, such as superheaters and piping for superheated steam, condensers, etc. Hence some reference to these features may not be out of place here.

## Curtis Turbine Generators.

The peculiar adaptability of the Curtis turbine to railway loads, which entail frequent variations in pressure and temperature, is in a large measure due to its having no revolving parts subject to high pressure or temperature. The parts subject to the full pressure and superheat, where superheat is used, strainer, throttle valve, valve chest and valves are made of cast or rolled steel. The process of expansion to the pressure in the wheel casing, which seldom exceeds 50 pounds, reduces the temperature of the steam to approximately that of saturation at the latter pressure, and it is the general experience that when difficulties in operation do arise from high temperature the turbine causes less concern on this account than any other steam apparatus in the plant.

## Steam Consumption.

Fig. 1 represents tests made by the Edison Illuminating Company of Boston, on a five-stage 5,000-kw. turbine of recent design. Table I gives results of individual tests.



8,000 KILOWATT 750 R. P. M. CURTIS TURBINE-GENERATOR, WITH SURFACE CONDENSER BASE.

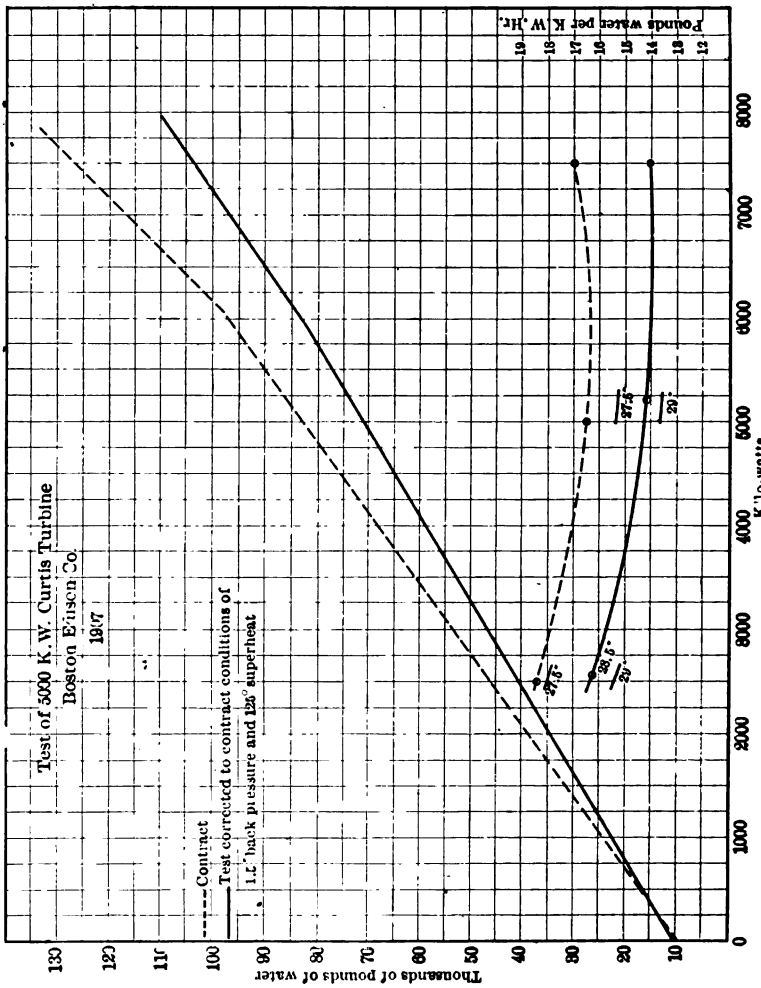


FIG. 1.— TESTS BY BOSTON EDISON CO. ON 5,000 KILOWATT 750 R. P. M. 60-CYCLE, 6,900-VOLT CURTIS TURBINE-GENERATOR.

## TABLE I.

### RESULTS OF TESTS ON 5,000-KW. CURTIS TURBINE.

Installed November, 1906, oil step, hydraulic valve gear, condenser base, generator 10-pole, 720 r.p.m. 60 cycles, 3-phase, 6,900 volts.

*Boston Edison Company.*

| Date, 1907. | Feb. 12. | Jan. 29. | July. 1. | Feb. 12. | Feb. 12. | Feb. 13. |
|---|---|---|---|---|---|---|
| Duration, hours | 1.00 | 1.17 | 1.00 | .33 | .33 | 1.00 |
| Kw.-load | 2,558.00 | 5,195.00 | 7,526.00 | 2,523.00 | 2,382.00 | 5,104.00 |
| Total water per hour | 38,997.00 | 70,492.00 | 103,353.00 | 41,445.00 | 41,820.00 | 78,483.00 |
| Steam pressure, gage | 173.00 | 173.70 | 167.70 | 171.00 | 173.50 | 172.20 |
| Steam temp. throttle | 526.10 | 519.00 | 509.00 | 535.00 | 536.00 | 539.40 |
| Superheat deg. Fahr. | 149.00 | 142.00 | 134.00 | 159.50 | 159.30 | 163.30 |
| Barometer | 30.11 | 30.48 | 29.95 | 30.12 | 30.12 | 30.43 |
| Vacuum inches Hg. | 28.98 | 29.30 | 28.60 | 28.25 | 27.63 | 27.51 |
| Water lb. per kw-hr. | 15.24 | 13.57 | 13.73 | 16.45 | 17.58 | 15.38 |

Table II.* gives the results of tests made by the Commonwealth Electric Co., of Chicago, on a five-stage 9,000-kw. 750 r.p.m. turbo-generator. The very high vacuum obtained in these tests is noteworthy and is probably due in a large measure to the surface condenser being placed in the base of the turbine. It is probable that the figures given in this table represent the highest attainment thus far reached in the generation of power from steam.

## TABLE II.

### TESTS OF 9,000-KW. CURTIS TURBO-GENERATOR AT CHICAGO.

Turbine 5-stage, condenser base, 750 r.p.m., generator 4-pole, 9,000 volts, 3-phase, 25-cycle.

| Load in Kilowatts. | Gage pressure lbs. | Vacuum inches. | Super-heat degs. F. | Wate rate lb. per kw-hr. |
|---|---|---|---|---|
| 5,374 | 182 | 29.43 | 133 | 13.15 |
| 8,070 | 179 | 29.35 | 116 | 13.0 |
| 10,186 | 176 | 29.47 | 147 | 12.9 |
| 12,108 | 182 | 29.34 | 148 | 13.05 |
| 13,900 | 198 | 29.31 | 140 | 13.6 |

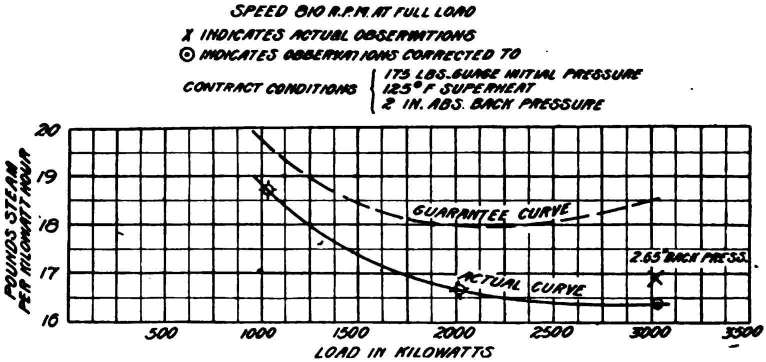


FIG. 2.— ACCEPTANCE TEST ON A 2,000 KILOWATT, 810 R. P. M., 27-CYCLE CURTIS TURBINE.

Fig. 2 shows the results of acceptance trials on a 2,000-kw. 4-stage 810 r.p.m. turbine, with a 6,600 volt 27 cycle generator, for the Westville power house of the West Jersey & Sea Shore Railroad Co. The tests were made at Schenectady for representatives of the purchaser. The overload test required some correction for vacuum on account of the condenser being defective. The other tests were made under contract conditions.

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* Presented by Mr. W. L. R. Emmet before National Electric Light Association, Washingtod, D. C;, June, 1907.

These tests indicate that the hourly steam consumption from no load to a point considerably beyond rated load follows a straight line when plotted to load and that the total consumption of steam includes a fixed amount (this being the amount required to maintain the machine at speed without load) plus an additional quantity proportional to the load. A high economy at light loads requires that the fixed amount required for no load shall be as small as possible. In the tests on the three machines referred to above, it is found that this constant is about 12.5 per cent., 7.1 per cent. and 14.2 per cent. of the steam consumption at full load respectively and the economy curves are correspondingly flat over a wide range in load. A first-class steam-engine and generator under similar conditions would probably have a no load steam consumption of not less than 15 per cent. of that required at rated load. The additional quantity of steam per kilowatt over and above this fixed amount at no load is 12.1-lb. per hour in the case of the Boston Edison tests. Steam at the pressure and superheat employed in these tests expanding to 1.5-in. absolute back pressure would generate one kilowatt for 9.27-lb. per hour in a theoretically perfect steam engine or turbine driving a generator of unity efficiency. It will be seen that, barring the unavoidable no load losses, the efficiency of the turbine amounts to about 16.4 per cent. of that theoretically obtainable. This represents a very decided step forward and indicates that we are approaching the practical limit of perfection in the production of power from steam.

## RATING OF TURBINE GENERATORS.

The high speed of turbine generators necessarily involves a close and compact arrangement of large masses of iron and copper which dissipate relatively large amounts of energy on small surfaces and in a small space. To adequately ventilate such machines, and avoid repeated circulation of the hot air in the immediate locality of the machine requires that cool air (generally from outside the station) be supplied to the generators in considerable quantities. When such provision for ventilation is made it is possible to continuously generate larger amounts of power in individual machines and thereby very materially reduce, not only the initial cost of the station, but the operating cost as well. The turbines were formerly designed to carry approximately full load non-condensing and in consequence had a very large margin of output condensing. Experience demonstrates that the non-condensing capacity is of little value. They operate at all loads without by-passing steam and the tests show their economy to be almost constant through a wide range in load. It, therefore, is desirable, in order to reduce the capital and operating costs, to operate them at their highest economical output with such a margin for momentary excess loads as actual service requires and with a due reserve for governing with a reasonable drop in vacuum and steam pressure under such conditions. Engines when designed for the most economical performance at rated load necessarily have a large overload capacity but operate when overloaded at relatively very poor economy and can only be used advantageously at overloads for comparatively short peak periods. Generators for engines have accordingly been designed with an overload capacity of 50 per cent. for two hours only. The fundamental difference in this respect between engines and the turbines under discussion calls for an entirely different ratio of capacities between generator and prime mover. Generators to be used with the turbines should permit the set to be operated continuously at a larger proportion of the maximum output of the turbine. Generators of the larger rating will show an appreciably better efficiency than those of the older rating. The economy of operating the turbine at the larger capacity has already been pointed out. Such a ratio of capacities naturally must change the basis of rating. If the generator's continuous capacity is to be made more nearly that of the turbine a smaller margin in temperature rise need be made for protracted overloads.

The advantages of this increase in generator capacity are obvious for power and lighting service as well as for large units in city railway service. Consideration of the load curves for stations carrying the more variable loads of interurban systems shows that it is also desirable in such service. For example, the load curve of the Westville power station of the West Jersey & Seashore Railroad for Sunday, August 25, 1907, is shown in Fig. 3.

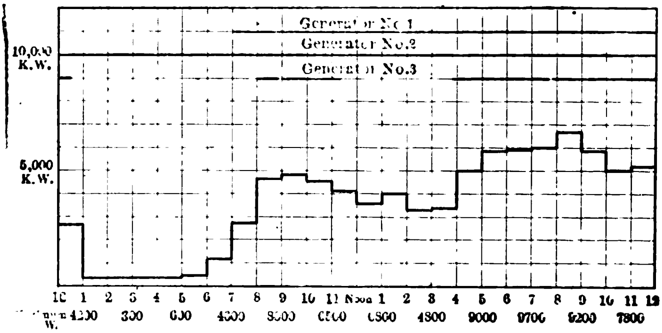

FIG. 3.—LOAD CURVES OF WESTVILLE POWER STATION, WEST JERSEY & SEA SHORE RAILROAD COMPANY.

It represents a particularly heavy day's operation with extreme momentary loads. This station is equipped with 4-2,000-kw. Curtis turbo-generators, but the generators are virtually machines of 3,000 kw. on account of being ventilated by forced blast taken from the air chamber for the air-blast step-up and rotary converter transformers.

The curve is drawn from the hourly readings of integrating watthour-meters and, therefore, does not represent momentary variations. The actual maximum out-put in each successive two hour period is indicated in the figures immediately below the curve and the number of machines in service by straight lines above the load curve. The maximum momentary loads determine the number of machines in service at any time and these momentary loads are of such extreme variation that the same number of turbines would be required for service regardless of the rating of the generators within reasonable limits, but the peak load lasts for five hours and is equivalent in heating to a steady load of not less than 6,300 kw. so that even in this case of an electrified steam road, with extraordinary load fluctuations, machines limited to a two-hour overload basis would have little or no margin as regards heating if limited to a ratio of 2,000 kw. generator rating to 3,500 kw. turbine output. Some margin is essential on account of the impossibility of maintaining unity power factor and the advantage of the larger generator capacity for a given turbine would become greater as the station load became larger and steadier.

## GOVERNING.

All of the large 25-cycle turbines are now equipped with hydraulically operated valves controlled by balanced pilot valves connected to the governor and taking oil from the step bearing pumping system. These governors and valves have proved reliable, permanent in adjustment, sensitive and responsive to abrupt changes in load and require very little attention in operation. They represent probably the greatest single improvement which has been effected in this type of turbine. They are ordinarily set for 2 per cent. change in speed and this degree of regulation is found sufficiently large to afford stable operation in parallel. It is the usual experience that after being adjusted for the correct speed at the factory, they seldom require alteration of speed or regulation when new machines are set up and paralleled with machines of the same type already in operation.

The very considerable Kinetic energy of these turbines and generators (far exceeding that of the fly-wheel and generator of engine-driven sets of the same capacity) contributes very largely to their responsiveness to extraordinary fluctuations of load and to their close speed regulation. As an example, the 3,500 kw. 750 r.p.m. 13,200-volt set has a total fly-wheel effect, $WR^2$, of approximately 320,000, and this represents at rated speed a stored energy of 30,600,000 ft.-lb. by virtue of which the machine, when working at any load, can carry an additional load equal to the full rating for about 0.75 of a second with a drop in speed of 3 per cent. and without additional steam, or a momentary increase in load of half the rating for 1.5 seconds, thus affording the governor plenty of time in which to act even if it were for any reason sluggish.

## LUBRICATION.

The step bearings of these machines are now lubricated with oil instead of water which was formerly employed. The change to oil involves the use of an additional shaft packing where the turbine shaft passes through the base, but as this packing has only to seal against the atmosphere its duty is relatively light and its operation simple. The upper bearings of these machines are now being lubricated under pressure from the step oiling system dispensing with tanks and sight-feed glasses. The pressure lubrication enables the bearings to be supplied with any quantity of oil desired. It is found that a flooded condition of lubrication in the guide bearings materially improves the operation of the machines as regards freedom from vibration. The oil is filtered continuously and an ordinary grade of mineral engine oil is satisfactory. Its specific gravity should be between .855 and .860 at 60 degrees F., and its viscosity as determined by Dudley Pipette should be between 45 and 56 at 100 degrees F.

### PRESSURE, VACUUM AND SUPERHEAT.

It will be seen from the tests presented that very noteworthy advances have been made in the economy of these machines. Further advance in station economy can be made by extending the temperature range through which the machine operates by increasing the pressure and superheat of the live steam and by reducing the temperature of the exhaust steam through better vacuum. The Curtis turbine has no inherent limitations to the economical conversion of such added energy at either end of the temperature scale.

Steam working from 200 lb. gage to 28-in. vacuum makes available about 5 per cent. more energy than steam at 150 lb. pressure while it requires only about 0.6 of 1 per cent. more heat, making a theoretical gain of about 4.4 per cent. due to this increase in pressure. The actual improvement in the economy of the turbine due to this increase would be about the same. Practically all of this is realizable inasmuch as the efficiency of the boilers under these two pressures would be substantially the same.

The addition of 100 degrees of superheat adds about 4.5 per cent. to the total heat of the steam and would require an extra fuel expenditure of approximately 6 per cent. and makes a reduction of about 8 per cent. in the steam consumption of the turbine, resulting in a net gain on this account of approximately 2 per cent.

This, however, does not represent the whole gain due to the use of superheat as compared with ordinary saturated steam operation, because such steam is never dry and a small amount of moisture causes an altogether disproportionate increase in steam consumption. The idea may be expressed by saying that the first 50 degrees of superheat is of appreciably greater value than the second 50 degrees. The large gain from superheat as compared with more or less wet steam was discussed at length by the late Dr. R. H. Thurston* as far back as 1900 in connection with steam turbine tests. While higher superheat will undoubtedly result in proportionately increased net economy its employment must in a large degree be dependent, not only upon the load factor and the size of unit to be employed, but also upon the nature of the service as regards severe and frequent variations in load, in view of the difficulties which have been encountered in the practical operation of superheaters, steam piping, valves, pumps and engine-driven auxiliary machinery.

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*"The Steam Turbine," R. H. Thurston, Trans A. S. M. E. Vol. XXII, Dec. 1900.

It seems probable that much of the trouble which has undoubtedly attended the use of superheated steam is due, not to any want of strength, but to want of elasticity in the parts affected and that they are not the result of high temperature so much as the unceasing variation in temperature incidental to the ordinary railway load. It is now generally believed that water may exist under certain conditions in the presence of superheated steam and if variations in load cause occasional priming of the boilers and water in the steam piping the resulting variation in temperature due to the spraying of heated surfaces is enormously increased. The substitution of annealed steel castings in place of cast iron fittings and valve bodies, the omission of copper gaskets and copper alloy internal parts in valves, better design of boilers and superheaters, so that the boilers will deliver only steam and no water to the superheaters and so that water can readily drain out of the superheaters and piping, are all factors which will permit the satisfactory employment of higher degrees of superheat.

The low velocities in steam piping which have become customary by reason of the pulsating flow of steam engines are not suitable for superheated steam. It is essential that the piping be made flexible to the greatest practicable degree and this requires small sizes of pipe. The steam pipes for Curtis turbines will require velocities of about 8,500 ft. per minute at their maximum ratings, based on saturated steam. One hundred degrees superheat will increase the volume of the steam about 15 per cent., but the velocity will be substantially the same on account of the reduction in the steam consumption of the turbine. The use of higher pressure and superheat will be facilitated by the introduction of steam turbine driven pumps and auxiliary machinery, and a satisfactory beginning has already been made in this direction in the shape of a high speed centrifugal circulating pump driven by a 75 kw. horizontal Curtis turbine for the condenser of the fourth 2,000 kw. unit in the Westville power station of the West Jersey & Sea Shore Railroad referred to above.

Improvement in economy arising from better vacuum is probably the most easily attained. Raising the vacuum from 28 in. to 28.5 in. makes 5 per cent. more energy available and of this the turbine realizes an improvement of from 0.5 to 0.6 lb. per kw-hr. at rated load, that is from 2.5 per cent. to 3.5 per cent., depending on the economy of the unit. Another way of regarding this is to consider that it adds just so much to the capacity of the station. To improve the condensing equipment is often the easiest way to lighten the duty on the boilers.

MR. KRUESI:— With reference to the use of superheat as compared with saturated steam operation, commercially dry steam is seldom less than one per cent. wet. One per cent. moisture will increase the steam consumption of the turbine, roughly, two per cent. so that the use of 100 degrees superheat will really result in a net economy of more nearly four per cent. as compared with saturated steam operation.

The saving indicated due to the use of high steam pressure would be equivalent to a reduction of about eighty-eight-tenths of a pound per kw. hour in the water rate of a turbine having a steam consumption of 18.0 lbs. per kw. hour. Higher pressure reduces the volume of the steam and permits the use of smaller pipes, the volume of steam at 175 pounds being 12 per cent. less than at 150 pounds and again 12 per cent. less for 200 pounds pressure. It has been stated that the use of higher pressure involves greater cost of boilers and piping. The difference between steel boilers, for say, 175 pounds, and boilers with cast iron headers which are sometimes used for 150 pounds, may be appreciable, but for a range in pressure from 150 pounds to 200 pounds, considering boilers made entirely of steel, this difference is actually only about three and one-half per cent. As regards the statement that an increase from 150 pounds to 200 pounds pressure will increase the cost of piping, the writer contends that if the piping is suitably designed for the use of superheat, it will be equally as satisfactory for 200 pounds as for 150 pounds at the same cost. For the use of superheat all flanges, fittings, and valve bodies should be made of steel and the thickness of such steel castings will be determined by foundry considerations and they will be abundantly strong for 200 pounds.

These three possibilities of improvement, while each in itself small, are nevertheless worth striving for and make a total possible improvement aggregating roughly eleven per cent. over what is frequent practice to-day.

### *Discussion of Mr. Kruesi's Paper.*

MR. ROBERTS:—As to superheated steam, I think that an increase of 50 lbs. would be advisable; but whether the boiler manufacturers would stand by the tubes or not under those conditions I question very much.

I don't want to say anything that would be detrimental to the turbine. I have quite a number of nice things to say about it. There is one thing that should be pointed out to you gentlemen who are contemplating the purchase of turbines, and that is that under varying loads at varying steam pressures you can depend upon the turbine to do work that a reciprocating engine cannot do. We have had some trouble with our turbine installation. One was the matter of taking care of the water of condensation in the exhaust line. I contended that there was no use putting a pump to work where an ejector wouldn't do any work, that is, no ejector or pump could pump against a vacuum. The proper way, I contend, is to warm the turbine first and then start up. That has been our contention for some time, and we do it regularly now, and have perfect operation.

So far as the variation of load is concerned, I would like to mention this interesting fact; that last Saturday we had a heavy load on our line and we were running seven 300 h.p. boilers with natural gas, the remainder of our plant, five 300 h.p. boilers were being fired up on coal. As we hadn't our coal conveyors in operation, this meant time. The pressure went down from 150 lb. to 85 lb. That was just about the peak of the load on Saturday afternoon. You appreciate the situation, I am sure. We wondered what was the matter that we couldn't keep up steam; so I had our chief engineer go down in the fire hole and he found the men were firing their heads off and couldn't keep steam. I went over to the gas house and found the trouble; it was there that our pressure went down to 85 lb. of steam and the engineer came around to me and asked me to come into the engine room, and said, "Look at that turbine; she is a peach." The turbine was operating at 85 lb. pressure and carrying all it could carry; and our 1,500 kw. and 800 kw. reciprocating engines were working with the valves wide open and were inclined to lie down. The value of a turbine under such circumstances is a feature worthy of notice.

The General Electric Company has asked permission from us to publish a chart that I forwarded to them and which proved of great interest. They have decided to use it in their bulletins. We showed a heavy load on the 4th of July, varying on the d.c. end, from about 2,500 amperes to about 750 amperes. We were working at 575 volts on d.c. end. We were also running commercial incandescent lights at 110 volts and city arc lights at 4,400 volts, and we were running a high tension road at 22,000 volts. You can see in the chart they publish that although we have that great variation in load, there wasn't a variation of 2 volts on the 110 volt circuit. So much for the pleasant features about the operation of the turbine.

Another thing I would like to say to you gentlemen is that if you are making any decision between turbines and reciprocating engines and we will have to come to that — I would advise you by all means to avoid a water step-bearing. The first turbine we had had an oil step bearing and we had no trouble with it. One trouble with our water step-bearing is that though we have practically pure water, we consume eight gallons of water per minute, and that at 6 cents per 1,000 cu. ft. amounts to an expenditure of about $7 in 24 hours. That would pay for quite a lot of oil. Another trouble was that we found that the very slight impurities we have in the water seriously affect the face of the bearings. I have had this water analyzed, and find it has 2 grains of sulphate of magnesium, 7 grains of carbonate of lime, and 7 grains of sodium chloride, per gallon, and yet with that slight amount of impurity in the water we found it was so deleterious to the bearings that we had to make frequent renewals. We have spent more on those turbines on renewals than on the rest of our plant in that station in the last twelve months. It is fair to say, however, that we had to purchase extra sleeves, etc., to be ready in case the turbine should need bearings renewed. Then, of course, there is the expense of the carbon rings; but altogether I question whether any engine builder would not be ready to guarantee a lower consumption of steam on a good reciprocating engine than anybody could guarantee on a turbine. When it comes to operation, I believe we would stand by the reciprocating engine.

Above all things, in relation to a turbine, be careful about your auxiliaries. If I had my way to go over again in putting a turbine into operation, and we undoubtedly will soon put more in operation, I would certainly not have a steam driven circulating pump. I would have a barometric tube condenser. We are operating ours without a dry vacuum pump and are getting from 28 to 28.5 inches at 1,080 ft. above sea. level. That is equivalent to practically 29 inches. The trouble is to get your water over without a dry vacuum pump. Once you get the water over, your vacuum is assured. By all means put in foot valves and you will get along without any trouble whatever. When you put in your pumps, be sure to put in electrically-driven volute pumps, not steam-driven, unless driven by steam turbines. It is impossible, I believe, to make any engine, no matter how good it may be, operate at the required speed and operate continuously, and give advantageous operation.

I might say more, but I would rather not. I certainly recommend the turbine to your consideration. I thank Mr. Kruesi for his paper.

PRESIDENT ADAMS:—I think Mr. Roberts' remarks are very pertinent to this subject.

MR. MITCHEL:—We have two turbines in operation and use the condenser water entirely for boiler feed.

MR. ROBERTS:—The water from the step bearing goes into the discharge end of the turbine, and is lost?

MR. MITCHEL:—It runs into the service connections.

MR. ROBERTS:—Well, I am sorry for you.

MR. MITCHEL:—The surface condensers have been most satisfactory in our case, and give us the best of boiler water. The cooling water is very dirty, and we are obliged to use a surface condenser to get good feed water.

MR. ROBERTS:—Tell the other fellow, who may have to pay for his feed water, there is required 70 lb. of water with the surface condenser, as against 30 lb. with the barometric tube condenser.

PRESIDENT ADAMS:—We would like to hear from Mr. Twining.

MR. TWINING:—I am not prepared to discuss the subject at all. I dropped in here only casually, and I am not in position to say very much about it.

Mr. Hewitt:— Mr. Chairman, I am hardly prepared to add anything to this discussion of steam turbines at the present time. In Philadelphia we are using turbines with both water step bearings and oil step bearings and we have had no particular trouble with either of them, except in one instance where the water was full of sediment and the passageways became clogged. I doubt very much if the trouble Mr. Roberts refers to is due to the water. The analysis which he has quoted does not indicate a corrosive water. It is probable there is some other explanation of the trouble.

I ask if any of the gentlemen have had experience with the exhaust turbines or direct current turbines. At the present time I am more especially interested in them.

Mr. Henshaw:— I think it might be interesting if the recent speaker who advocated electrically-driven auxiliaries would expound a little further on that point. There are some who think they are rather dangerous. The final efficiency of the electrically-driven auxiliaries is not as good as that of the steam-driven auxiliaries, and there are also a good many reasons why it is better to have steam-driven auxiliaries, rather than to go way around to the secondary source of power. As the gentleman is so emphatic in his recommendation of electrically-driven auxiliaries I think it would be interesting if he would explain a little further why he considers them the proper thing. I would add by the way, with regard to the high speed required for pumps, that there does not appear to be any particular objection to running pumps with turbines, and I have recently seen — perhaps a number of you have also — boiler feed multiple-stage pumps driven by steam turbines in the New York Edison Waterside Station, New York City. I think they also have them in the Brooklyn Edison Station.

Mr. Roberts:— I must say that our auxiliaries, that is the pumps, are driven by a vertical engine, and you know that when a vertical engine runs faster than 300 revolutions per minute you have what I might advisedly term an unnatural speed. Now, the speed we want to run at on these pumps is 480 revolutions per minute, and that is a perfectly natural speed for an alternating current motor. It is the ideal speed, and when the motor is running at that speed, it is running just right. We have to speed up the engines occasionally to 430 or 435 revolution per minute to get the water over the head. That is why I am in favor of motors.

We have in another plant a pump driven by a motor where we are lifting the water 15 feet to the pump, driving it horizontally 750 feet and lifting it 54 feet at the end of the drive, and I am quite sure we have not been shut down on that plant four hours a year on account of any trouble with our motor-driven pump. The reason we put in reciprocating engines there on the Bullroot pumps was because our chief engineer wished to use the steam for water heating purposes. It might have been arranged so as to have avoided that and still operate, and we are sorry now that we did not do it. I trust my explanation meets the gentleman's inquiry.

President Adams:— I ask Mr. Baker if he will not kindly say something on this question. I think he has some information on one station that was almost put out of commission by an electrically-driven pump.

Mr. Baker:— I think some of the troubles mentioned by the speaker might be overcome by changing the type of pump and reducing the speed by increasing the size or diameter of the impeller in the pump which would reduce the number of revolutions per minute, so that it could be easily operated by an engine.

Another thing I understood Mr. Roberts to say in connection with the subject of electrically-driven auxiliaries was that he did not care for economizers. It seems to me there would be a loss of economy without economizers, or, in other words, that he would be feeding cold water into his boilers.

There is considerable that might be said on this question one way and another. If any questions were asked I would try to answer them but I do not know that I care to say more in general discussion.

President Adams:— We have with us Mr. Dudley W. Farrand of the Public Service Railway, and we would be glad to have him say something on this subject.

Mr. Farrand:— Mr. Chairman, I did not come prepared to take part in the discussion of this subject, but to listen and to learn. A number of different phases of the question have been brought out, some of which add to our experience and some of which are not very important. In our system we have a variety of stations, and a great variety of engines, boilers and turbines. As regards the water step, we have changed ours to oil, have had no trouble whatever as far as the step is concerned, and we think we get a little better results. We did not have any serious trouble with the water, but we find we do get better results with the oil, that is, we are able to run with greater clearance and find the oil a better lubricant.

We are using with all Curtis turbines a surface condenser for the reason that we have ample condensing water, but not boiler water. We have to buy our boiler water. With the change from water to oil on the step bearing we do not get quite the temperature in our condensed water as when we used water on the steps, because we got the heat units out of the step and it is necessary to make up that difference in temperature as our surface condensers and heaters were designed for use with the water step.

We have been running one of the turbines over three years. The first turbine was installed in an ordinary steam plant, and was designed for 175 lb. pressure and we were only able to give it 140 lb., but allowing for the difference it approximately meets its guarantee.

We have had a case of generator trouble due to defective insulation, but so far as the turbine itself is concerned it has had nothing whatever to do with it, the trouble being with the generator.

Considering the question of first cost, at the present time I do not see how any company can afford to put in anything but turbines in the large installations. The difference in first cost per kw. would provide a very much greater capacity, and talking on the investment side of the question alone there is no doubt about the difference in value of the turbines.

So far as the auxiliaries are concerned, I prefer to put in high pressure steam auxiliaries, of sufficient capacity so that they may be run at slow speed. It seems to me foolish to take generator capacity and apply it to the driving of auxiliaries, when you want to use that capacity in the service. There are fewer complications with steam-driven auxiliaries and they are more reliable. I am not prepared to make a speech but would be glad to answer any questions.

Mr. Mitchel:— In the Edison Station in New Orleans, all the auxiliaries were electrically-driven, but these were taken out and supplanted by steam-driven apparatus which is now in use.

Mr. Palmer:— The Old Colony Street Railway has been through a somewhat similar experience. We have some 10,000 kw. capacity in Curtis turbines installed at Quincy, and three 500 kw. machines installed in our Newport Lighting Station. We started at Quincy with all auxiliaries electrically-driven, but our experience was such that when the fifth unit was being installed, we put it in with steam auxiliaries. We expected great results from our operation with electrically-driven airpumps, etc., but after some practical experience with them, we found it very advantageous to have steam-driven.

You can easily imagine the condition of the plant operated entirely with electrically-driven auxiliaries, after the relays of these auxiliaries have operated and shut them down.

We find the operation is much more flexible where we have some steam-driven units, and, besides that, we need the steam to heat up our feed water. As to the step bearing proposition we have water in use for the step in one plant and oil in the other. We deemed it best to use surface condensers at our Quincy power plant. The feed water is expensive, as it has to be bought, and the circulating water is salty, and it is therefore an object for us to use the surface condensers. Our step bearing water discharges directly into the condenser, and we have had no experience which would lead us to seek a change. We can say the same thing of our oil step bearing proposition at Newport. The experience we have had there has been equally gratifying, but, of course, we have to pay for the oil, whereas in the case of the water lubricated step bearing we have to add about so much water every day to our hot well, to make up, and so we may say that the step bearing water costs nothing, and we get a higher temperature of feed water by the use of it.

I would like to ask Mr. Kruesi if the figures that are quoted for the percentage in gains in economy for steam pressure, vacuum and superheat, are those which apply generally for all sizes of machines; for instance, for the 2,000 kw. size, 5,000 kw. size, etc. As I figure it out, you get .88 per cent. decrease in steam consumption for every 10 lb. rise in pressure. Does that apply equally to all sizes?

MR. KRUESI:— Substantially.

MR. PALMER:— And about one per cent. for every 12.5 degrees of superheat?

MR. KRUESI:— Yes.

MR. PALMER:— And that is the latest information as derived from your latest turbines?

MR. KRUESI:— Yes.

MR. PALMER:— It is but a comparitively short time ago, if I am not mistaken, that the claim was made of an increase in economy of one per cent. for every ten degrees of superheat, and I have been lately given some figures calling for one per cent. for every fourteen degrees of superheat. I ask if this increase in economy in superheat applies also to all ranges and sizes?

MR. MITCHEL:— I ask Mr. Kruesi if he will please enlighten us, if there is any difference in economy between the surface condenser and the jet-condenser in turbine operation?

MR. KRUESI:— Replying first to Mr. Roberts in regard to the water step bearings, I think I am safe in saying there are over one hundred machines operating in various parts of the world, from Japan to South Africa, with water step bearings, and operating in a satisfactory manner, and several reports have been made here to-day of satisfactory operation with water. I think Mr. Roberts' trouble was due to the deposit of salts on the lower wheel, due to the spraying of the water in passing through the turbine base, which would throw the turbine out of balance. Similar cases arose, in Cuba, and one or two other places where good water was not available, and it became necessary to design oil step bearings for these machines. As the manufacturers of these turbines did not want two or three designs of step bearings, it being essential that the turbines should be standardized, they decided to change all new machines to oil steps and that is now the standard. The sentence on page 267 of my paper would answer Mr. Roberts' point. It is as follows: "The step bearings of these machines are now lubricated with oil instead of water which was formerly employed."

So you see that Mr. Roberts' advice to buy no turbine without oil step bearings really has no present application.

As regards higher steam pressure it is necessary, I think, to avoid drawing general conclusions from particular experiences. Mr. Roberts has had some difficulty with boiler tubes, and on the other hand, any number of instances might be cited where satisfactory operation has been had with boilers at 175 and 190 lb. pressure in connection with steam turbines all over the country. In the same way I believe it to be an error to condemn engine-driven circulating pumps because in one particular instance the pump was designed for too high speed. A circulating pump for the conditions such as Mr. Roberts had to deal with can be designed for a wide range of speed, and there is no reason why it could not be designed for 75 revolutions if desired. That is about the speed of the pumps in the Commonwealth Station in Chicago, the same engine, driving the dry air pump which of course must run at slow speed.

The question of motor-driven or engine-driven auxiliaries is too large to be entered on here and will have to be passed. Motor-driven auxiliaries are open to the same objections as motor generator exciter sets. The experience has been that they are not free from objection. Sufficient steam could be had for feed water heating when motor driven auxiliaries are used by taking steam from the first or second stage of the turbine at about atmospheric pressure. All Curtis turbines are furnished with flanged openings so that if any one desires to heat water in that way it can be done. It is being done in a number of instances. The turbine uses the steam down to the pressure where you abstract part of it at a higher efficiency than most engines which would be used for driving auxiliaries so that it would be economical to use no steam-driven auxiliaries, but there are other objections, on the score of reliability, against motor-driven auxiliaries which would offset that. I think turbine-driven auxiliaries are very desirable, and I expect a very rapid increase in their use.

Mr. Roberts, I think, made a statement to the effect that with regard to liability of operation engines are still to be preferred. There, again, is danger in drawing general conclusions from a particular instance. It is my observation of a large number of plants in different parts of the country, that when anything goes wrong with a new lot of apparatus which accompanies the installation of the turbine, all the troubles are laid to the turbine, whether it is the fault of the turbine or not. Many difficulties which are incidental to the auxiliaries are ascribed to the turbine, simply because they went in at the same time as the turbine and are involved with it. I think many of Mr. Roberts' troubles have been condenser troubles and not turbine troubles.

Mr. Roberts read a statement from a book to the effect that the steam consumption of the engine is to be preferred. I could quote a statement from the last report of the Turbine Committee of the Edison Association to the effect that the economy of the turbine is now better than that of any steam engine.

With regard to the figures for superheat, pressure and vacuum, such statements as I have made here must naturally be general statements. I could not make any other statements unless I gave a table applying to each particular turbine. The improvement to be gained from a given amount of superheat would depend upon the size of the turbine under consideration, because a 1,000 kw. machine, for example, would have a water rate of about 20 lb., whereas a 5,000 kw. turbine would have a water rate of about 17 lb., and one per cent. on 17 lb. is different from one per cent. on 20 lb., naturally, and so the statement I make is general, and the actual improvement in pounds per kw. hour would depend on the particular machine. I can make statements as to the gains obtained from superheat, which would naturally be different from that guaranteed. There must be a margin in the guarantee. No conservative manufacturer will guarantee to the full limit of gain which he knows will be realized, and that might account for the difference referred to by Mr. Palmer. The same is true in regard to the figures for vacuum, but these are general statements which would apply with a fair degree of approximation to all the larger sizes of Curtis turbines.

MR. ROBERTS:—I wish to present a quotation from a well known work on Steam Turbines by Lester G. French, which is a recent publication. After a lengthy comparison between reciprocating and turbine engines, the writer says:

"Comparing these figures with those of Table XVIII, it seems probable that the reciprocating engine will, under exceptionally good condition, show a little better economy than the turbine, when running at its most economical load; but that what we have called the 'average high-grade engine' appears to about equal the turbine in its rate of steam consumption at most economical loads. In the next chapter the question of variable loads will be considered."

A foot note reads as follows: "In discussing the paper by Parsons, Story and Martin, before the Institution of Electrical Engineers, May, 1904, E. J. Fox said: 'Taking figures of steam economy as given by Mr. Parsons for different sizes of turbines, there is no difficulty whatsoever in the reciprocating engine giving equally good results up to the 1,500 kw. size. From 100 up to 1,000 kw., the results obtainable with reciprocating engines are better. When you come to the 1,500 kw. size, there is very little difference between the two; and finally with the 3,000 kw. size, I think there is no doubt a considerable difference in favor of the turbine.'"

PRESIDENT ADAMS:—We will have to call this discussion closed and ask Mr. J. R. Bibbins, Engineer of the Westinghouse Machine Company, to present his paper on "Recent Developments in Steam Turbine Power Station Work."

# RECENT DEVELOPMENTS IN STEAM TURBINE POWER STATION WORK

## WITH SPECIAL REFERENCE TO THE FORT WAYNE & WABASH VALLEY TRACTION COMPANY SPY RUN STATION.

BY J. R. BIBBINS, *Engineer,*
Westinghouse Machine Company, East Pittsburg, Pa.

If any one feature may be said to characterize recent engineering practice in turbine power plant construction, it is that simplification of operating equipment which lowers investment, cost, labor and up-keep and the possibility of service interruptions, the while, preserving a degree of working economy commensurate to the service in view. The underlying object is, of course, the maximum commercial, rather than physical efficiency. And this applies as much to auxiliary as to principal generating practice. A very important factor contributing to this desired simplicity of plant, is compactness of arrangement such as permits the subdivision or grouping of related apparatus more or less on the unit principle. Thus, in many modern stations, each unit is served by a certain group of boilers and an independent set of auxiliaries, so that in the event of trouble, the damage may be entirely isolated. In one plant (Carville), all auxiliaries are motor-driven, and at starting, all motors of a particular section, "pick up" load with the main generators to which they are connected. With this system, the absence of exhaust steam for feed heating, is made up by the use of economizers. In the case of the condenser, the old centralized plant has developed not only into individual units, but particularly condensers located directly beneath the turbine. And, owing to the relative bulk of the surface type, this has again led to skeleton turbine foundations, and finally, to constructions of steel or reinforced concrete.

To what an extraordinary degree of compactness turbo-machinery has attained, is evidenced by Fig. 1. Less than one-fourth of the horizontal Corliss, and less than one-third of the vertical, the turbine in larger sizes require but 1/20-sq. ft. per generator h.p. This has further brought about radical changes in boiler plant arrangement. In place of the familiar square power house, divided equally between parallel boilers and generating rooms, the latter now occupies barely one-third of the total, and boiler batteries are arranged at right angles to the turbine room to provide for the otherwise cramped boiler capacity without unduly lengthening either building or steam piping; for example, Carville station, Newcastle (Eng.); Gould Street station, Baltimore; Commonwealth station, Chicago; Waterside station No. 2, New York City, etc. In many cases, the value and limitations of the site have even necessitated multiple-decked boiler rooms, such as Waterside No. 1 and No. 2; Lots Road station, Chelsea (London); Long

Island station, Pennsylvania R.R., New York City; Kent Avenue station, Brooklyn, etc.

Another important development has taken place along lines calculated to foster heavy peak and emergency overloads; in the generator, forced ventilation; in the turbine, auxiliary or secondary admission of steam to assist on overloads without detriment to the economy on normal loads; in the boiler plant, mechanical stokers; and mechanical draft auxiliaries to normal chimney draft; *e. g.*, Waterside station, New York; Kent Avenue station, Brooklyn; Neasden station, London; Carville station, Newcastle; Delray station, Detroit, etc. The equipment of these stations thus provides exceedingly valuable forcing capacity. At Kent Avenue, overloads of 75 per cent. during peak, are not infrequently sustained on the turbines, and a similar machine of 7,500-kw. capacity at Waterside No. 2 sustained nearly 100 per cent. overload during emergency. Thus, an essential requisite of the modern turbine, is unusually rugged construction, even at the expense, to a certain degree, of fine economies, obtainable at best only under extremely favorable conditions, which are seldom obtained and never maintained.

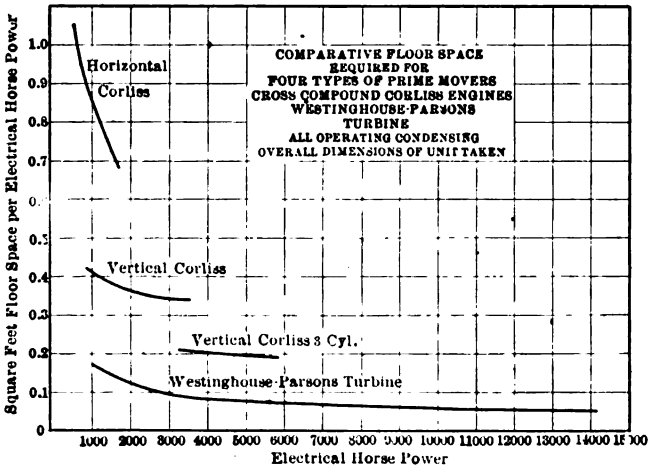

FIG. 1.—COMPACT FLOOR SPACE OF TURBINE.

The vital necessity of security against total interruption has, in the most modern station, taken form in the provision of an auxiliary storage battery floating on the exciter bus. This battery comes into actual use perhaps only once or twice a year, being entirely idle during the rest of the time. But, on these few occasions, the importance of uninterrupted service usually far outweighs considerations of cost and maintenance. In the Gould Street station, Baltimore, a recording chart of exciter bus voltage covering the period of exciter breakdowns, showed not the slightest fall of voltage, due to the instantaneous substitution of battery current.

### COMBINED SERVICE.

A development of considerable importance, especially in the field of moderate sized power properties, is the combination of services of different characters in a single central generating station,— such, for instance, as interurban railway and central station lighting. This, of course, has been common practice where the same kind of current is distributed, but by no means general when the services have been kept distinct. A number of systems have been put into operation, or projected within recent years which embody this feature of combined service. Of these, the Ft. Wayne system, later described, is typical.

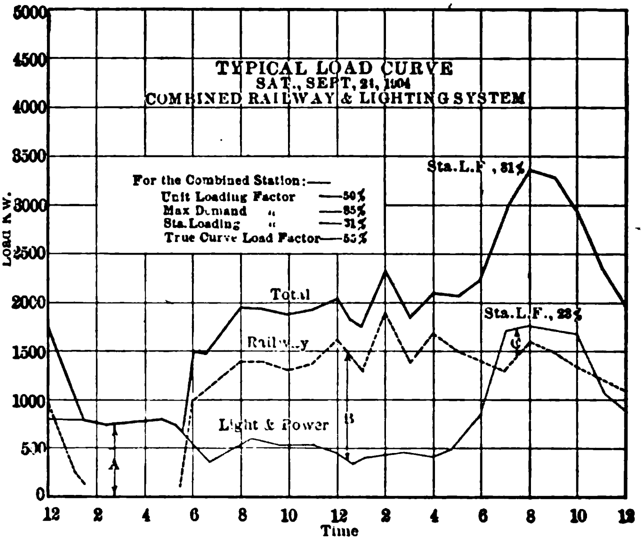

FIG. 2.—TYPICAL LOAD CURVE.

This system possesses at least one important advantage — the more effective working of boiler capacity — perhaps the most fruitful field for effort toward the improvement of plant efficiency. In the generating room, the two systems are presumably independent electrically, unless interconnected through a frequency changer which, although complicating the equipment somewhat, might prove invaluable in emergencies. Steam, on the other hand, is generated to meet the average load of both systems, irrespective of frequency. This will be clear from a study of load curves, Fig. 2, and the accompanying analyses, Table I — data taken from an actual system, such as the Fort Wayne, and of about the same size. The curves represent a Saturday load only, but are typical of other days. Note first the relative loading of generating units. For the lighting load, yielding a true loading factor (average ÷ maximum) of 39 per cent., which is high, the average unit loading is but 34.6 per cent. of the rated capacity. But, the railway load gives a unit loading of 67.8 per cent. rating; and combined, the plant operates at an average unit loading of 50 per cent., which is also high, considering the relative size of the units, 1000 kilowatts. This problem, of course, reduces to the question — whether two small plants can be operated at respective unit loadings of 34 per cent. and 68 per cent. more efficiently than a combined plant of 50 per cent. unit loading — undoubtedly so. Fig. 2 shows in a general way, how well the systems superpose. Thus, lighting load at (A) makes up for the early morning deficiency in railway load. During the day, the situation is reversed as at (B). In the evening, railway load usually falls off as lighting load increases (C).

## TABLE I.

### Analysis of Load Curves — Combined Railway and Lighting Systems.

| | | Average 24-hour load. Kw. | Average load when running. Kw. | Factors. | | | |
|---|---|---|---|---|---|---|---|
| | | | | (1) Unit. loading factor, per cent. rating, per cent. | (2) Max. demand factor, per cent. | (3) True loading factor, per cent. | (4) Station loading factor, per cent. |
| Saturday, Sept. 24. | Railway<br>Lighting.. | 1,058<br>692 | 1,355<br>...... | 67.8<br>34.6 | 95<br>89 | 56<br>39 | 35.3<br>23.0 |
| (Curves) | Station... | 1,850 | ...... | 49.9 | 85 | 55 | 31.0 |
| Sunday, Sept. 25. | Railway..<br>Lighting.. | 921<br>471 | 1,034<br>...... | 50.2<br>47.1 | 75<br>123 | 61<br>38 | 30.6<br>15.7 |
| | Station... | 1,392 | ...... | 53 | 88 | 53 | 23.2 |
| Wednesday, Sept. 28. | Railway..<br>Lighting.. | 1,050<br>634 | 1,230<br>...... | 61.5<br>31.7 | 75<br>79 | 70<br>40 | 35.0<br>21.0 |
| | Station... | 1,685 | ...... | 45.4 | 72 | 58 | 28 |

(1) Average load when running ÷ capacity of unit.
(2) Maximum demand from load curve ÷ capacit running.
(3) Average 24-hour load ÷ maximum from load curve.
(4) Average 24-hour load ÷ station capacity, including one spare unit each 25 and 60-cycle.

This question is, however, best answered by Fig. 3 representing the variation of cost and efficiency with station loading factor average load ÷ station capacity for this same system. It is notable that an increase in the *lower* loading factor brings the *greatest* increase in efficiency. From 25 to 30 per cent., the decrease in operating cost was 15.7 per cent.; from 30 to 35 per cent., 9 per cent. This shows that considerably more is gained by increasing the lighting factor than is lost by decreasing the railway, which, together with the decreased boiler standby losses and the good effect of centralization, represents the net results of the combination of operating systems. In the one case, 3.1 times the average day boiler capacity is necessary to carry the lighting peak; for the entire plant, but 1.8 per cent. This not only lowers standby losses, but also materially reduces the boiler capacity necessary for a given turbine output. Thus, at Fort Wayne, there is installed but slightly over 0.5 boiler h.p. per kw., whereas, the usual allotment is 0.75 boiler h.p. and over.

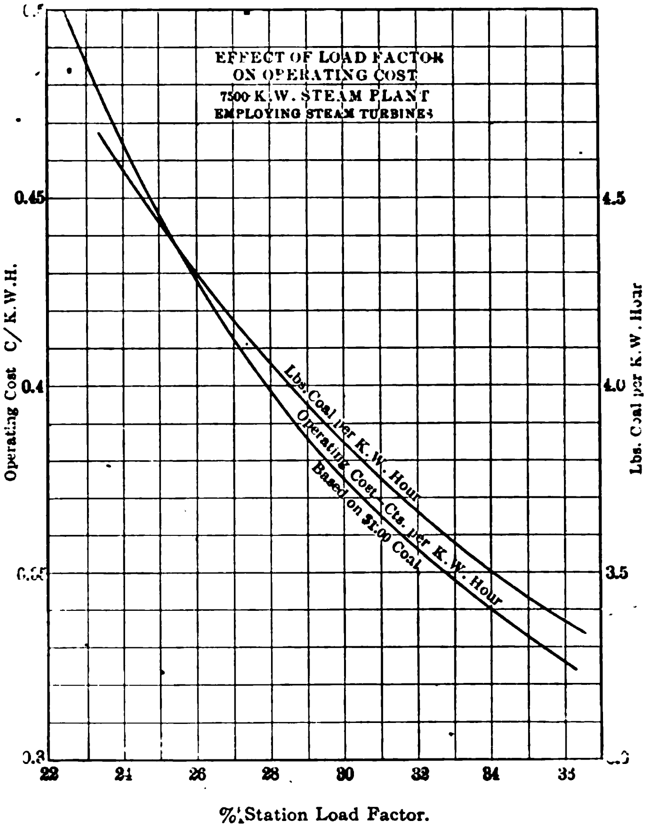

FIG. 3.— EFFECT OF LOAD FACTOR ON OPERATING COST.

## THE FT. WAYNE STATION.

The above notes serve to introduce the principal subject of the paper — a consideration of the characteristic features of the new electric service station of the Ft. Wayne & Wabash Valley Traction Company at Ft. Wayne, Ind. Executed along decidedly novel lines, it presents an unusually interesting study of the engineering possibilities of turbine plant construction.

*Service.* Like many other similarly situated railway concerns, the Ft. Wayne & Wabash Valley Traction Company has adopted the policy of developing light and power business in connection with its traction system — serving both traction and lighting systems from a central power station, as previously outlined. In the city of Ft. Wayne, this

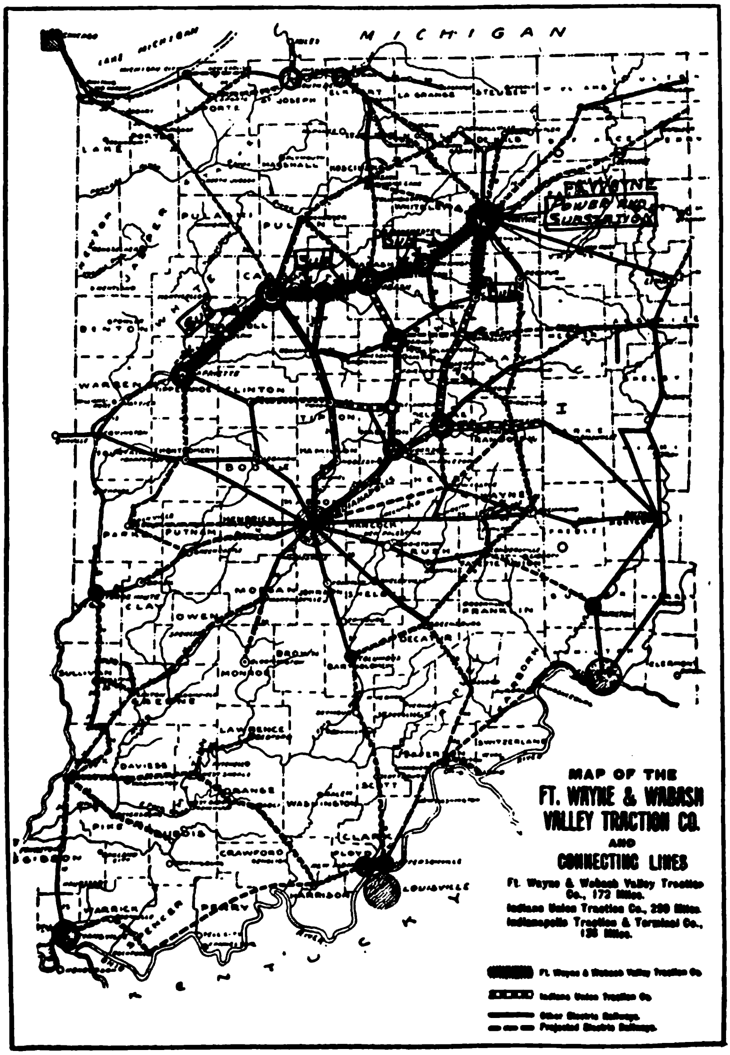
MICHIGAN
FT. WAYNE POWER AND SUBSTATION
LOUISVILLE
MAP OF THE
FT. WAYNE & WABASH VALLEY TRACTION CO.
AND
CONNECTING LINES
Ft. Wayne & Wabash Valley Traction Co., 172 Miles.
Indiana Union Traction Co., 200 Miles.
Indianapolis Traction & Terminal Co., 135 Miles.
Ft. Wayne & Wabash Valley Traction Co.
Indiana Union Traction Co.
Other Electric Railways.
Projected Electric Railways.

FIG. 4.— MAP OF FT. WAYNE & WABASH VALLEY TRACTION CO. SYSTEM.

business has assumed such proportions that nearly one-half of the new power station is devoted to 60-cycle lighting equipment — the remainder to 25-cycle equipment for traction purposes. The extent of the system is apparent from the accompanying map, Fig. 4. High tension transmission lines parallel the railway from Ft. Wayne to Lafayette — a total transmission distance of 112 miles from the source of supply. En route, the lines touch Wabash, Logansport, Huntington, Peru, and numerous smaller towns, in most of which considerable lighting business is available. Along this route are eleven rotary converter substations ranging in capacity from 200 to 500-kw., totalling 3600-kw., or somewhat in excess of the present station generating capacity. But as the maximum demands from these substations do not superpose, owing to the distribution of cars, there results at the station an unusually uniform load for traction work.

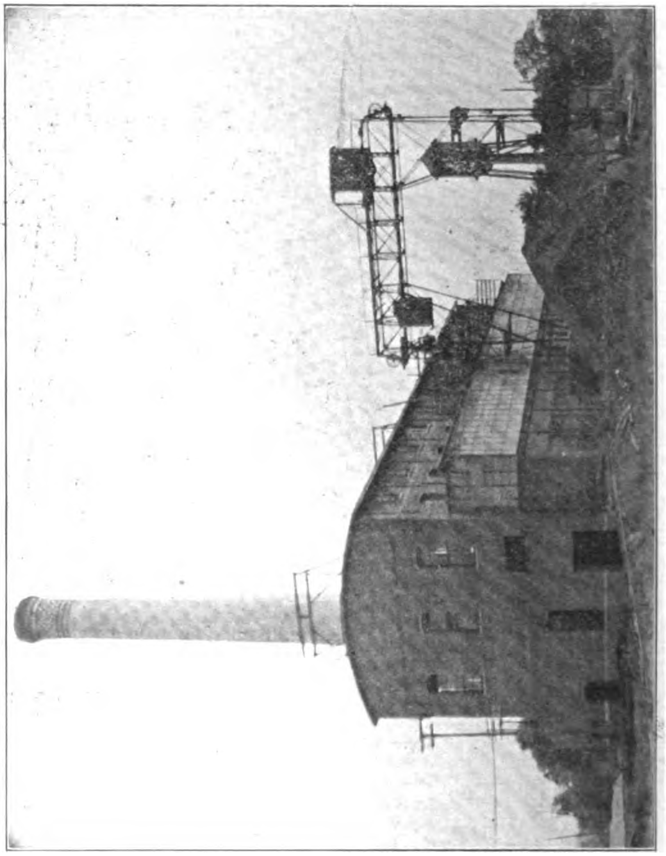

Fig. 5.— General View of Station Showing Coal Storage.

The site chosen parallels a small stream — St. Joseph's river — from which the water supply is drawn for both feed and condenser purposes. Owing to the contour of the country, the 25 feet difference in level between river bed and station floor, was unavoidable. A lower location would not only have introduced difficulties in coal trackage, but also would have endangered the station at periods of excessive flood, to which the stream is liable.

Referring to the accompanying photographs, Fig. 5 is a general view showing the coal bunker ranging along the building wall with

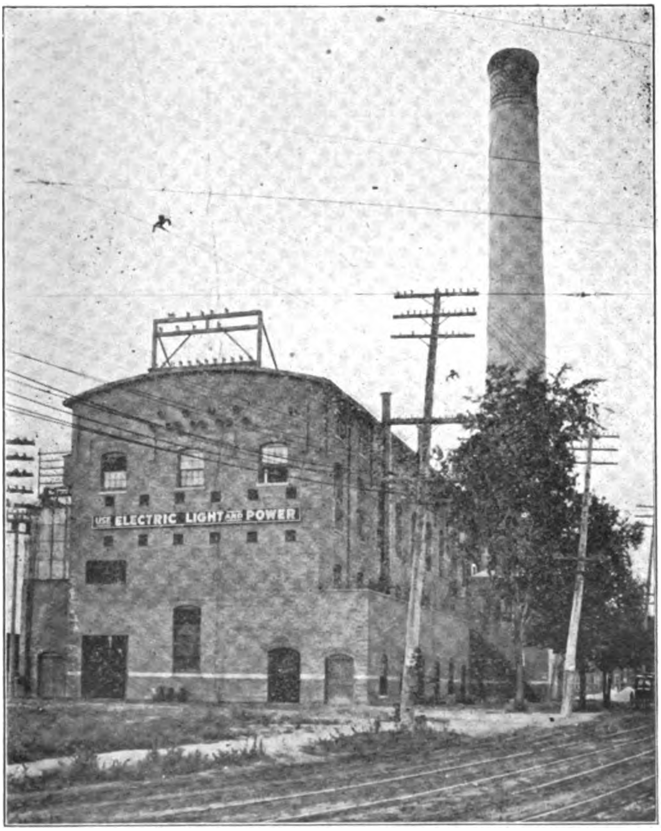

FIG. 6.— GENERAL VIEW OF STATION SHOWING SMOKE FLUE EXTENSION.

Gantry service crane. Underneath this coal bunker, is room for machine shop, boiler auxiliaries and lavatory. In the distance is a tank serving to keep a constant head on the high pressure pumps.

Fig. 6 is a similar view from the opposite end of the building on the chimney side, showing the smoke flue extension with the pump room beneath; also the free exhausts from the turbines and high tension transmission outlets.

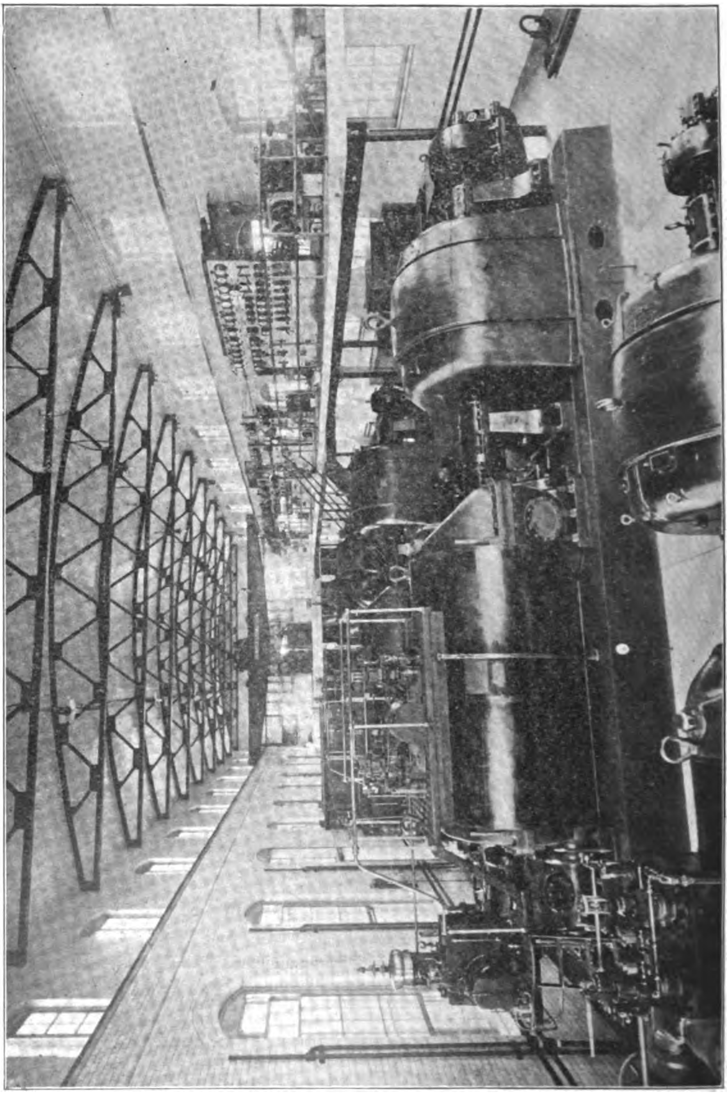

Fig. 7.— General View of Upper Generating Room.

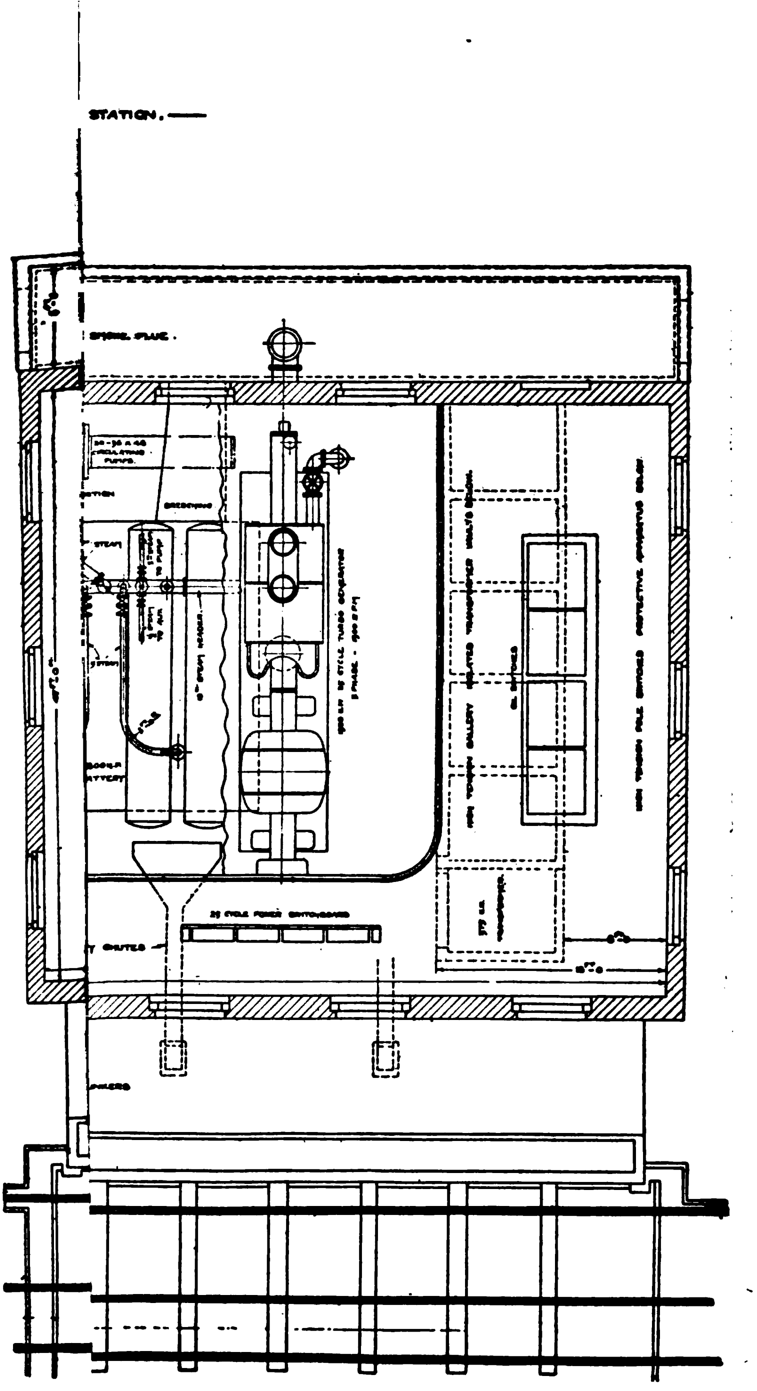
STATION.
SMOKE FLUE.
24-36 & 48 CIRCULATING PUMPS.
BREECHING
STEAM
8" STEAM HEADER
1500 K.W. 25 CYCLE TURBO GENERATOR
3 PHASE - 1500 R.P.M.
BOILER
25 CYCLE POWER SWITCHBOARD
CHUTES
HIGH TENSION GALLERY ISOLATED TRANSFORMER VAULTS BELOW.
OIL SWITCHES
HIGH TENSION BUS SWITCHES PROTECTIVE APPARATUS BELOW
375 K.W. TRANSFORMER.
6'-0"
12'-6"
STOKERS

Fig. 7 is a general view of the upper generating room with the various switchboards arranged along the side gallery, and high tension switches and transformers at the further end. This view shows one of the incidental advantages of the double-decked arrangement in an exceedingly attractive and well lighted turbine room.

Figs. 8 and 9 show the station in plan and section.

In Fig. 10 an attempt is made to show the steel supporting structure for the turbine room, and the condenser arrangement. This will be referred to later.

Fig. 11 is taken along the top of the boilers, and shows the general arrangement of the steam piping with the 10-inch header at the left, superheater outlet piping in the foreground and blow-off and feed mains at the right. This view also shows the steel air duct work supplying air to the generators from the main longitudinal duct at the right over the boilers. The hot air from the generators discharges through the flap door in the foregoing. The equipment schedule appended covers the principal apparatus in the station. The principal features of the station may be summarized as follows:

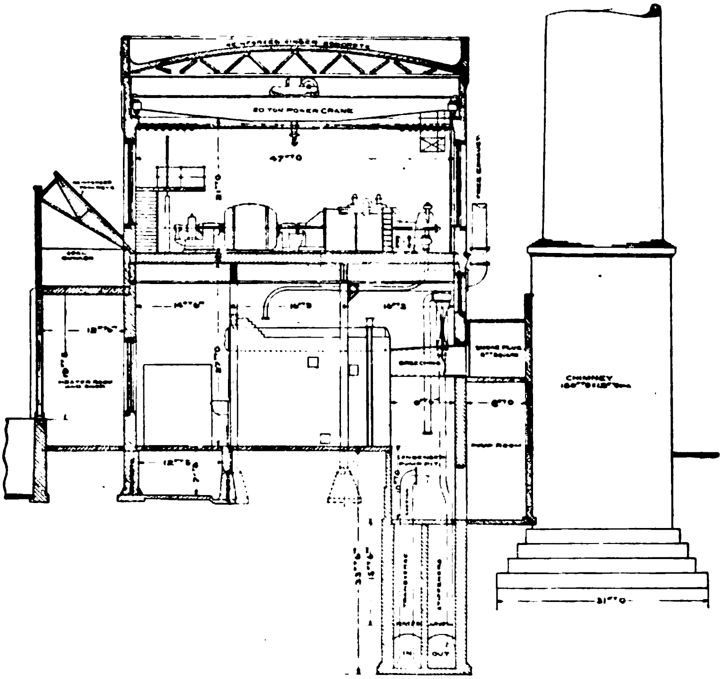

FIG. 9.—SECTIONAL VIEW OF STATION.

(1) A two-story, rectangular brick structure with side wings for the accommodation of auxiliary apparatus, coal bunker, machine shop and stores.

(2) Generating machinery on second floor over boilers.
(3) Structural foundations with concrete arch floor construction.
(4) Independent barometric jet condenser — moderate vacuum.
(5) Gravity conduit system for cooling water.

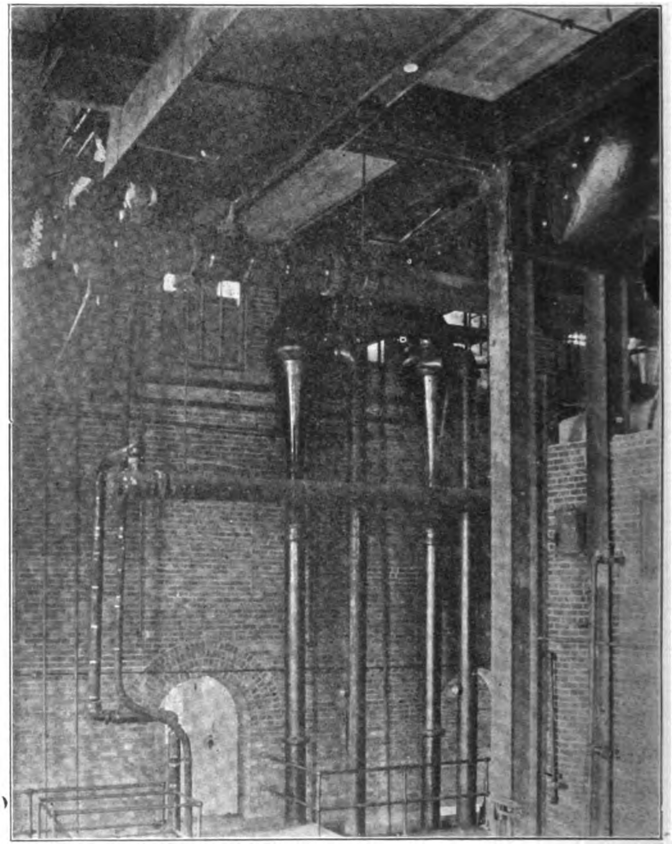

FIG. 10.— VIEW OF STEEL SUPPORTING STRUCTURE AND CONDENSER ARRANGEMENT.

(6) Independent, direct-driven exciters — common bus for each system.
(7) Steam piping — simple, short and direct, with continuous upward slope from boiler nozzle to turbine throttle.
(8) Sufficient superheater surface to maintain dryness, or moderate superheat at beginning of expansion in the turbines — 100° to 125° at the boiler.
(9) Mechanical stoking with gravity fuel feed.

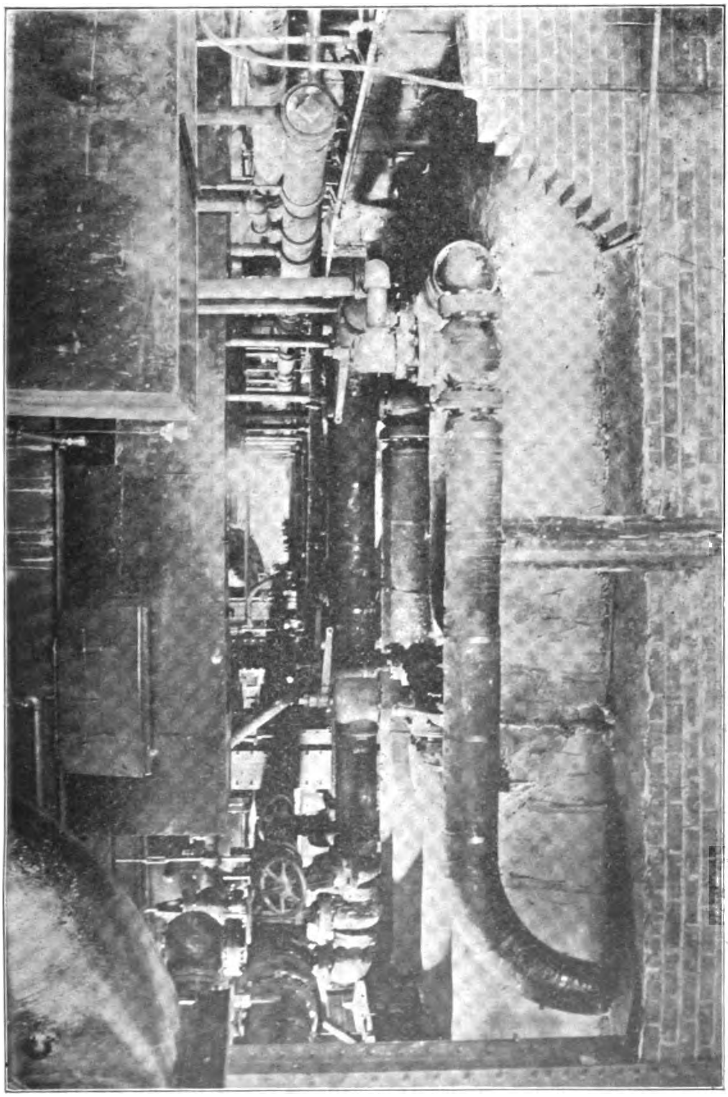

Fig. 11.—View Showing General Arrangement of Steam Piping.

(11) 6000-ton (two months') coal storage, served by Gantry crane.
(12) Steam driven auxiliaries for feed heating.
(13) System of forced ventilation for turbo-generators.
(14) Fireproof transformer compartments, with transformers mounted on rolling trucks to facilitate removal.
(15) Remote control oil circuit-breakers with time limit overload relays.

Essentially the station represents an attempt to produce a power property that will show to best advantage in the balance sheet with a medium price coal — one in which the absence of engineering "frills" for securing the highest efficiency, is compensated for by lower capital cost. This should be borne in mind in the discussion of the operating results later noted.

## TABLE II.

*Data on Power House.*

| | |
|---|---|
| Dimensions of building, ground floor plan (47 ft. by 177 ft. 2 in.) | 8,340 sq. ft. |
| Dimensions of condenser room (9 ft. 6 in. by 177 ft. 2 in.) | ............ |
| Dimensions of pump room (8 ft. by 177 ft. 2 in.) | 1,419 sq. ft. |
| Dimensions of heater and pump room (12 ft. 6 in. by 173 ft.) | 2,160 sq. ft. |
| Total area of power house | 11,919 sq. ft. |
| Total area of power house, single deck basis | 20,273 sq. ft. |
| Height boiler room, 28 ft. 6 in.; turbine room to crane rail, 21 ft. 7 in. | |
| Present capacity, 60-cycle, 3,500 kw.; 25-cycle, 3,500 kw. | 7,000 kw. |
| Ultimate capacity | 8,500 kw. |
| Ultimate capacity, entire plant max. rated overload | 12,750 kw. |
| Present substation capacity, 1,300 kw. ultimate | 2,600 kw. |
| Present boiler capacity, 10 400-h.p. | 4,000 bo. h.p. |
| Ultimate boiler capacity, 12 400-h.p. | 4,800 bo. h.p. |

*Relative area —*

| | | |
|---|---|---|
| Station, ground floor plan | 1.39 | sq. ft. per kw. ult. |
| Station, single floor plan | 2.39 | sq. ft. per kw. ult. |
| Operating room (floor plan) | 0.98 | sq. ft. per kw. ult. |
| Operating room (exc. high-tension and substation equipment) | 0.722 | sq. ft. per kw. ult. |
| Boiler room (net floor plan) | 1.74 | sq. ft. per bo. h.p. |
| Total boiler room and bunker | 2.19 | sq. ft. per bo. h.p. |
| Boiler settings (24 ft. 8 in. by 23 ft. 5 in.) | 0.725 | sq. ft. per bo. h.p. |
| Relative boiler capacity, ultimate | 0.56 | bo. h.p. per kw. |

*Building.* As previously pointed out, the building construction in turbine power plants is largely influenced by arrangement of boiler equipment. In this case, it was apparent that a somewhat lower boiler capacity than usual would be required for the combined service. For moderate sized units, a well equipped boiler room requires from 2 to 2.5 sq. ft. per boiler h.p. In some extremely compact arrangements, requiring as low as 1.5 sq. ft. per boiler h.p. The Ft. Wayne arrangement works out 1.75 sq. ft. per boiler h.p. Assuming a capacity ratio of 0.6 boiler h.p. per kw., the floor area then works out slightly over one sq. ft. per kw. for boiler room alone.

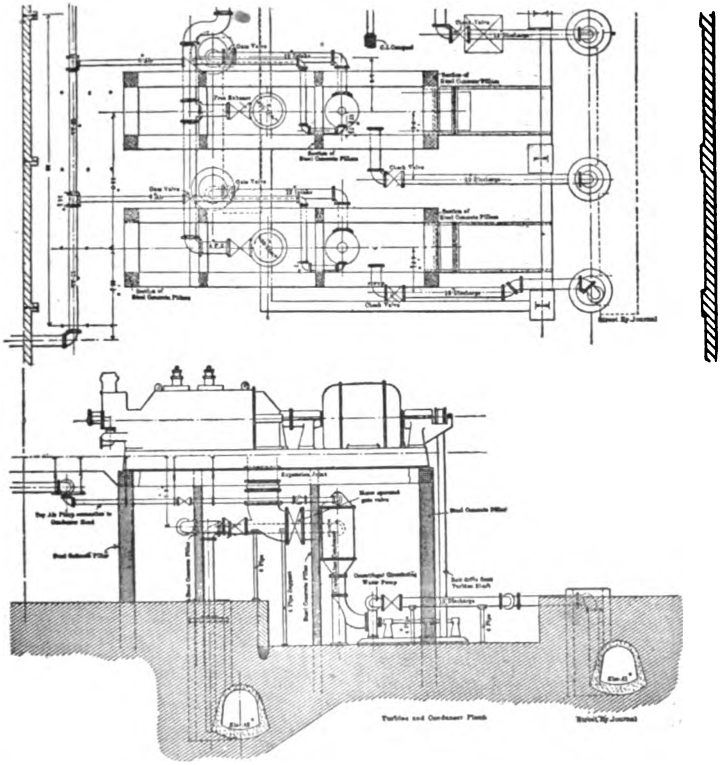

FIG. 12.—CROSS SECTION OF TURBINE AND CONDENSER ARRANGEMENT RELATIVE TO FOUNDATION, PHILADELPHIA RAPID TRANSIT CO.

Now, for a fairly compact generating room in a station of this size, from 0.75 to 1.15 sq. ft. per kw. are required, as will be seen from the comparative data on turbine stations, later noted (Appendix B). But, for the Ft. Wayne plant, some provision had to be made for the accommodation of d.c. substation apparatus. Assuming one sq. ft. per kw. as a reasonable area, we find that this practically coincides with the above boiler room area. The designer thus had two alternatives: First, a double-decked power station, or second, a building of twice the area with two equal sized operating rooms in parallel and under one roof. That this arrangement would be preferable, from an investment standpoint, is hardly open to question. As it stands, the

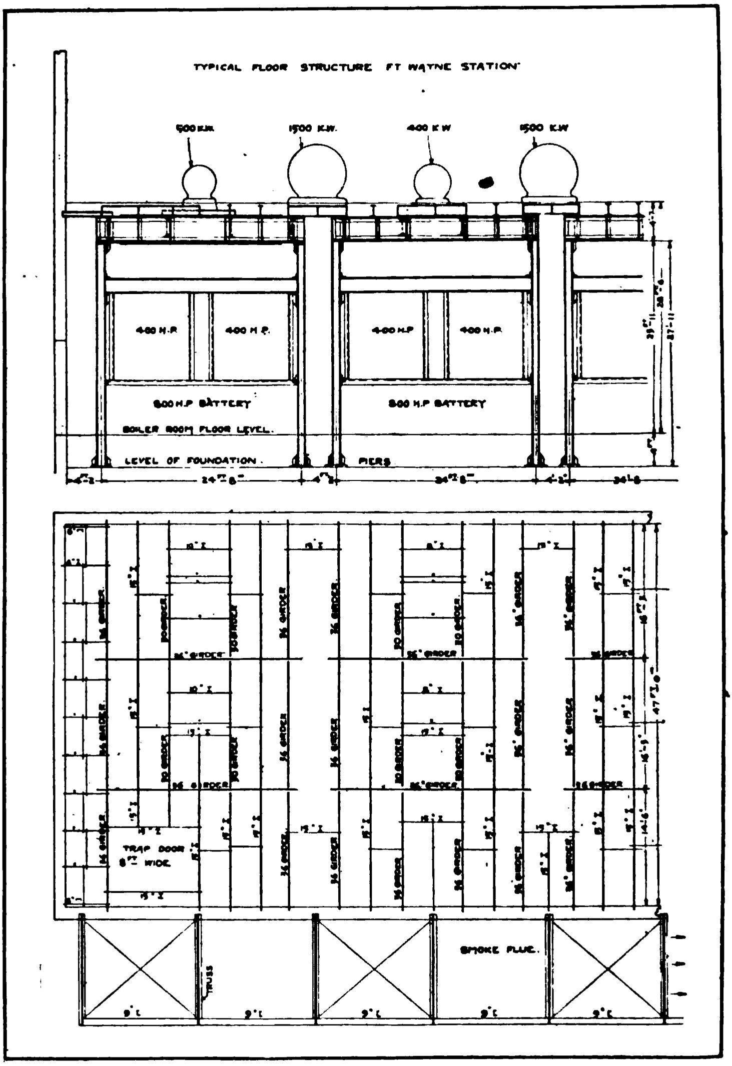

FIG. 13.— DETAIL OF FLOOR STRUCTURES.

building cost about $11.00 per kw., including additions, which is by no means excessive.

Inseparable from this building arrangement, is the question of structural foundations, which are entirely justifiable in the cases of steam turbines owing to the absence of cyclical movement arising from unbalanced parts requiring, in the case of low speed reciprocating engines, the most rigid foundations. Moreover, there was ample precedent for this type of foundation structure, notably the two turbine stations of the Philadelphia Rapid Transit Company. Fig. 12 shows a cross section of the turbine and condenser arrangement relative to foundation. Here reinforced concrete columns 20 ft. in height and 10 to 15 inches in section, support the entire turbine floor, as shown in the drawing. These machines are 1,500 kw. capacity, spaced 14-foot centers.

The floor structure of the Ft. Wayne station is shown in detail in Fig. 13. It consists of individual pairs of transverse plate girders extending across the building under each turbine bed plate. Short cross girders serve to tie the longitudinal girders together at column intersections, the whole forming "bents" or cradles between the several generating units. Box columns divide the building width into practically three equal spans, these columns rising between the several boiler batteries. Thus the weight of the generating machinery is distributed between two building walls and two rows of columns. Only in the case of the smaller machines and rotaries does any of the weight fall upon the areas intervening between columns. In order to insure even settling, the precaution was taken of carrying footings for both columns down to practically the same level so as to encounter homogeneous strata.

*Boiler Plant.* It is apparent from Fig. 13 that the location of the large turbines was chosen so as to accommodate under each floor "bent" a single battery of boilers. With the small boiler units chosen, this, of course, provides a larger turbine room above than is necessary; but, by utilizing the excess floor space for substation apparatus, this disadvantage is largely overcome. The floor plan drawing, Fig. 8, shows to what advantage the space has been utilized.

It is noteworthy here that with larger boiler units, a far more compact arrangement would be possible with little increase in floor span between batteries. Fig. 14 shows clearly the relative reduction in boiler area for units ranging from 500 to 2,000 h.p. The majority of these are the standard B. & W. type setting, with single tiers of tubes. In case of a special demand for stations of the Fort Wayne type, it is quite possible that a boiler could be obtained giving a much narrower battery than with the standard setting, but with ample grate surface.

This relative disposition of boilers and turbines evidently permits of the simplest form of piping. Strictly on the unit principle, this would involve but two bends, as shown in the cross sectional drawing, Fig. 9. The addition of an equalizing header running the length of the building then, complicates the piping only to the extent of extra valves, fittings and hangers, resulting in:

(1) Most direct path of steam from boiler to turbine.
(2) Equalizing connection to compensate for variations in the rate of steaming of boilers in service.
(3) Provision for most convenient distribution of boiler capacity to carry any load.
(4) A cost of $2.50 per kw. for steam piping, complete.

In the normal running of the plant, effort is made to keep those boilers in service nearest to the turbines in operation, thus giving the minimum distance of steam flow. When occasion arises, the plant may be operated on the unit system, valves in the header between the various risers being supplied for this purpose.

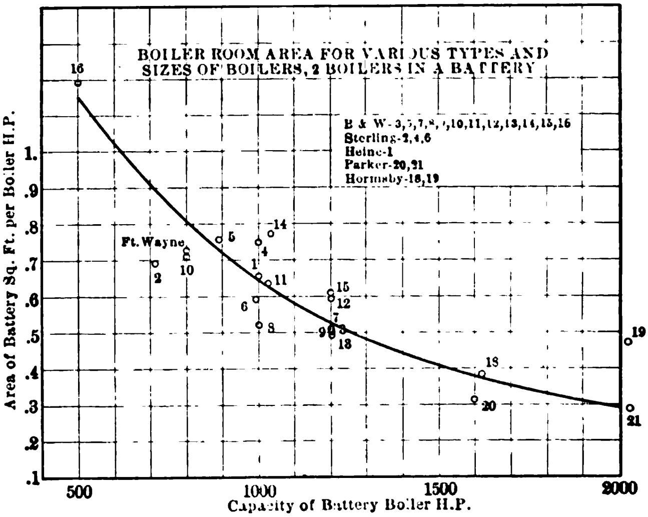

FIG. 14.— BOILER ROOM AREA.

Superheaters were installed principally for the purpose of insuring thoroughly dry steam at the beginning of expansion in the turbine. Although the presence of moisture in the steam system is not encountered in normal operation, the precaution was taken of delivering steam from the boilers underneath and discharging it above the header, so that a continuous draining is provided from turbine throttle back to boiler. This is likely to be an advantage in starting a section of the plant that has stood idle for a time.

In the arrangement of the breeching, the main smoke flue might have been run inside the boiler room walls, thus avoiding the breech connection shown in Fig. 9. This, however, would have necessitated locating the condensers outside of the building. With the present arrangement, a ten-foot space back of the boilers is ample for all condensing apparatus, and the space under the external smoke flue is utilized as additional boiler room area for small auxiliaries, oil filters, etc.

Superheated steam is provided direct from the main to all principal auxiliaries in the plant. This avoids an auxiliary steam main. According to customary practice, the auxiliary main draws its supply from opposite extremities of the steam system so as to avoid to the greatest degree possible, a shut-down of auxiliaries. At Fort Wayne nearly the same security is provided by connecting auxiliaries directly into the steam main at different points. Thus boiler feed pumps are connected in duplicate to opposite sections of the steam main, each of which is supplied by at least four boilers. Similarly, condenser pumps are connected to the same section of the main as the turbines which they serve. (See Fig. 8.) If a turbine unit is disabled, the pumps will not, of course, be needed.

The absence of economizers will be noted. These were not considered necessary with coal at $2 to $2.50 per ton. For feed heating, auxiliary exhaust steam is entirely relied upon — all boiler, service and condenser pumps, also fan and stoker engines contributing heat through the medium of open heaters. Exciters are direct-driven, as later noted. Nevertheless, a feed temperature of 160° to 180° is obtainable during the day, and 200° at night. This feed is drawn from the hot condenser discharge tunnel and delivered to the elevated tanks, shown in Fig. 10, which provides a static head on the heaters and is of sufficient capacity to supply the plant for three hours at full load. Similarly, the heaters are elevated a few feet to insure a positive lift of feed pump valves. With this feed system, boiler cleaning is not necessary oftener than at monthly intervals.

Mechanical stoking was adopted, not only to minimize labor cost, but also to provide ample forcing capacity for peak loads or emergencies. With Hocking Valley screenings, three men can handle, without difficulty, ten boilers, or 1,330 boiler h.p. each. Hand firing for the same capacity, would require ten firemen and two water-tenders, or 400 boiler h.p. per fireman, a reduction of 60 per cent. Present boiler room labor, averaging $11.75 per 12-hour shift, would be increased to about $28 per shift, providing 12-hour shifts could be maintained.

*Condenser Plant.* The character of river water had, of course, an important bearing on the design of the condenser system. Although carrying considerable sediment at times, the water is extremely soft and develops no hard scale even after many weeks of continuous running. This annulled the principal advantage of the surface condenser; viz., return of pure exhaust steam for feed water. The 25-foot difference in level between ground floor and low water made one of two condenser systems imperative:

(a) Surface condenser with continuous pipe loop (balanced water column), with power-driven circulating pumps to overcome fluid friction.

(b) Barometric jet condensers mounted near the level of turbine exhausts with tail pipes extending downward to the normal river level, with power-driven circulating pump to overcome excess barometric head.

With the former, auxiliary dry vacuum pumps would be imperative in order to prevent the condensers from becoming air-bound, or losing their vacuum altogether through air leaks in the water system, thus adding another auxiliary. Moreover, the surface type of plant is extremely bulky and would have seriously interfered with the "double-deck" layout.

On the other hand, the barometric type fits particularly well into the scheme. The condenser head may be suspended beneath the turbine where its most bulky part is out of the way. The tail pipes may then be carried down at any angle or turn sufficient to clear necessary obstructions. Thus, the 9.5-foot area way which would ordinarily be provided in the rear of the boilers is conveniently utilized as operating space for all condensing apparatus.

With the arrangement employed, as shown in Figs. 8 and 9, a difference of about 47 feet exists between the condenser head and low water level. This, however, does not interfere with the operation of the condensers, as a partial void simply results in the upper part of the barometric column.

The use of twin condenser units permits the use of less bulky apparatus, and also makes it possible, in the event of the disablement of one side, to continue operation on the other with reduced vacuum. Long stroke reciprocating pumps were chosen for this purpose instead of high speed centrifugal pumps, as being best suited to the high lift — sixteen feet. With this type of pump, a small air chamber will suffice to carry over the moment of reversal without any "dip" in vacuum, which would otherwise accompany the non-uniform flow of injection water. This equipment without dry vacuum pumps, yields a vacuum during warm weather of about 26.5 to 27 inches at full load (referred to 30-in. barometer). Its simplicity and ease of up-keep, is apparent, especially in view of the low cost — about $2.50 per kw., including pumps and piping, but no tunnel work.

Water is conducted to and from a screen house on the river bank entirely by gravity through a double-duct concrete conduit. At the river a double screen prevents debris from entering the intake, which is at right angles to the current, while the discharge is down-stream. This conduit system, of course, necessitated considerable excavation in the rear of the boilers. The two retaining walls were then reinforced at intervals by transverse stiffener arches sprung across the pit.

*Coat Storage and Handling.* The Ft. Wayne plant uses normally about 100 tons of coal per day. In the provision for coal storage, an elevated bunker of relatively small capacity (400 tons) fulfils all requirements for gravity feed. Even this would tide the plant over a period of at least three days in case of failure of coal handling apparatus. The main storage yard will contain about 6,000 tons — sufficient for two months' supply, but only about 4,000 tons is ordinarily held in stock, except in case of impending fuel shortage. Fig. 5 shows the Gantry crane serving this storage yard. It combines the function of unloader, crusher, elevator and distributor. Its efficiency is attested by the fact that, while its normal capacity is considered to be one 50-ton car per hour, the operators have unloaded a 40-ton car in sixteen minutes, and a maximum of eleven cars (500 tons) in a short working day. The crane is electrically operated from a single controller tower by one man.

*Generating Plant.* The two sections of the generating plant, 25-cycle and 60-cycle, are, of course, separated electrically, and each, therefore, controlled by a separate switchboard. Two additional boards control the rotary converter output for both 25-cycle and 60-cycle systems, the latter consisting of a d.c. power circuit for elevators and other intermittent power. A fifth board controls the exciters. With perhaps the exception of the exciters, the generating plant is quite standard throughout. In place of the usual steam-driven exciter unit, with motor-driven duplicate, each generating unit is provided with its own direct-connected exciter, all generating at the same voltage — 125 volts. Each exciter has sufficient capacity to carry two generators. All may be connected to a common bus, as an emergency condition. Normally the exciters for the 25 and 60-cycle generators are separated to permit the use of independent voltage regulators.

Assuming the case of instantaneous fluctuating loads, the voltage regulation of a direct-connected engine-generator-exciter unit, is not, of course, comparable with that of steam-driven exciters, due to cumulative drop in speed and voltage. Of the three systems, (a) independent steam-driven exciter, (b) independent motor-driven exciter, (c) exciter-driven by prime mover, the first undoubtedly gives the best results. But with the use of the automatic voltage regulator, the three are brought practically to an equality.

This subdivision of exciter capacity assures uninterrupted service to a degree quite impossible with the usual arrangement of independent exciters, and almost to the same degree as the standby storage battery quite frequently employed as an insurance against current interruptions. With half the exciters in the station inoperative, there would still be ample capacity remaining.

These direct-connected exciters add 2.6 per cent. to the expense of the main generating unit. A detailed comparison of the total cost of the exciting plant, as compared to the cost of an inequivalent independent exciting plant, including reserve unit, shows some 20 per cent. in favor of direct drive.

All the generators draw their supply of ventilating air from a sheet steel duct running the length of the plant above and in front of the boilers. This has served its purpose, but a positive pressure fan has been installed as an auxiliary to accelerate the air flow during certain prevailing winds when the required draft is more difficult to maintain through the long supply duct. This system of positive generator ventilation has the advantage of maintaining low generator temperatures the year around, while by means of the fan auxiliary a large excess of air can be supplied to any of the units that may be for any reason abnormally overloaded. In other words, the fan blast may be regarded as a generator auxiliary. It makes possible greater generator overloads.

*Turbines.* In some large turbine plants of recent design where considerable distance must necessarily intervene between switchboard operator and turbine throttle, it has been found desirable to control the running speed entirely from the switchboard by a small motor-driven mechanism connected to the governor. This system has undoubtedly advantages from an electrical standpoint in synchronizing and distributing load. Yet in compact stations, such as Ft. Wayne, it seems a better plan to commission the engineer in charge with entire authority over the mechanical equipment, as is the case. All speed adjustments are taken care of at the individual governors by the engineer or from the switchboard.

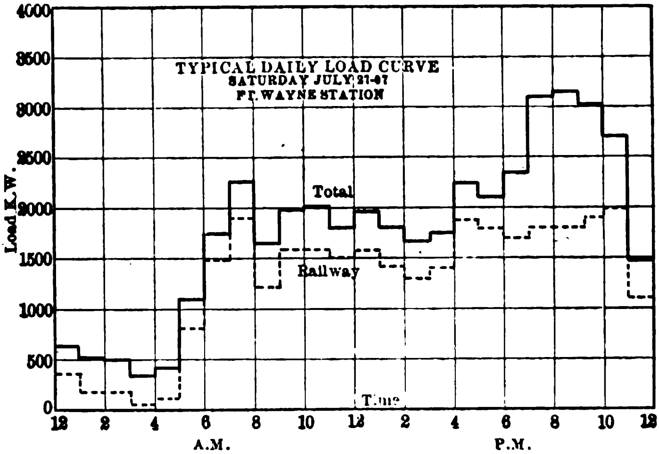

FIG. 15.—TYPICAL DAILY LOAD CURVE.

Designers of large plants also tend to concentrate in a continuous return cooling and filtering system, the usual independent oil system used on these turbines. At Ft. Wayne, however, the independent system has been used, largely with the intention of isolating trouble in so important a function as the lubrication. Each turbine has its own oil pump, cooler and strainer reservoir, all of which apparatus is readily accessible from the engine-room floor. When desired, however, the oil may be entirely drained out of any of the machines into the filter below where it is screened, washed and returned by a small steam pump.

*Operation.* Owing to the brief period in which the Spy Run station has been in operation, it is not possible to analyze very accurately either the operating efficiency or the operating costs. Moreover, considerable

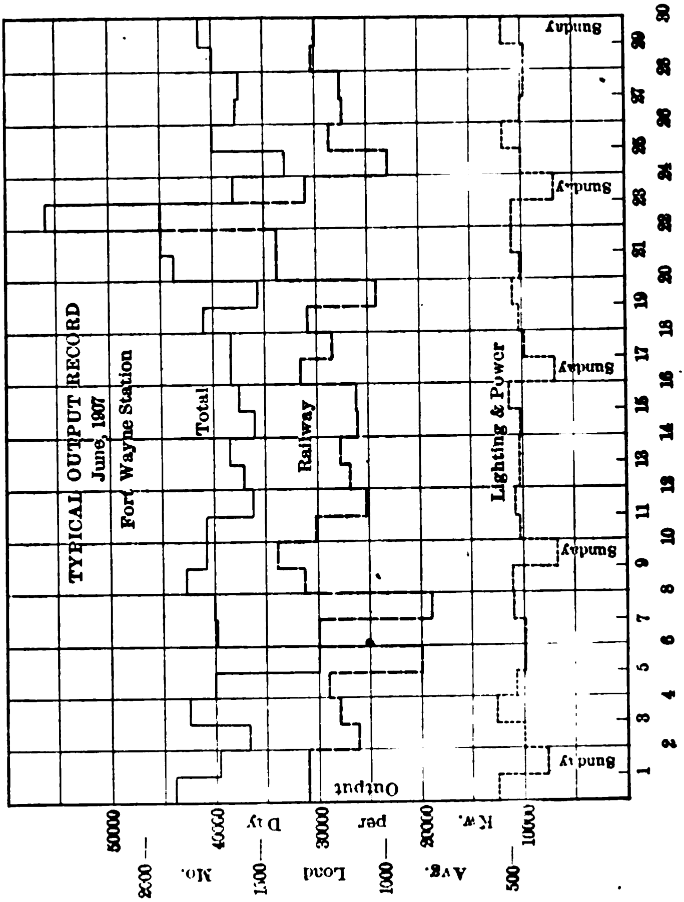

Fig. 16.— Typical Output Record.

extensions are under way, which will materially increase the loading factor of the station. During the month of June, the Ft. Wayne station turned out 24 per cent. of its rated output. Fig. 15 shows a typical daily load for Saturday, the loading factor from which is about 33 per cent. of 24-hour capacity. The dotted line represents the railway load alone, and for uniformity, could hardly be improved. Combined with the lighting, the station is still loaded very efficiently, with the result that, while there is but little advantage from the traction standpoint, by combined operation the lighting system is greatly improved. Here arises the greatest gain from the combined system. Following these load characteristics through the month, we find little change in the relative load from day to day. Fig. 16 shows lighting, traction and total load for the month of June. It is noticeable that the regular drop in Sunday lighting load is usually made up by the increased Sunday railway load, which will generally be the case on all holidays.

Now, taking this month as a basis, we may predict with some degree of certainty, the change in operating efficiency and cost with the improved loading factor, by applying data from the similarly equipped and operated system previously noted in Figs. 2 and 3. This data was obtained at a time when the system had developed to just about the same extent as the present Ft. Wayne system. Assuming the average loading factor of a normal lighting system to be in the neighborhood of 23 per cent, this data shows a reduction in operating cost of nearly 30 per cent. (to 0.35 cents per kw-hr.) by increasing the loading factor to 33 per cent. of the output capacity of the station. Owing to extensions in city and suburban traction, a loading factor of 40 per cent. at least, may be expected at Ft. Wayne. It is, therefore, evident that an extremely low power cost may be anticipated. How much the various mechanical contrivances around the station have contributed to the low cost, is shown by the fact that the labor cost for the entire station, including coal handling, averages but $34.60 per 12-hour shift, equivalent to 0.12 cents per kw-hr. at 33.5 per cent. loading factor, which is considerably lower than the usual figure in steam plants. Even this could be reduced about 10 per cent. at the present, as several men, in training for outside service, are now maintained upon the regular station pay-roll.

*Costs.* In the final analyses of the ultimate cost of power, fixed, or capital costs, of course, have an important bearing, and it is in this regard that the type of station exemplified in that previously described, exerts the strongest influence. In the preceding discussion, it has been the object to show wherein the double-decked station has made the greatest advance along engineering lines. Owing to the absence of many refinements, it is evident that the maximum possible efficiency could hardly be obtained. In compensation, we should look for a considerable reduction in the capital charges in order to bring the total cost of the power generated to as low a point as would result from the use of a more efficient plant. This proves to be the case with the Ft. Wayne station.

Analyses of the total power costs from modern steam plants of 5,000 to 10,000, kw. capacity, show that the capital costs, including interest and depreciation, amount to about 50 per cent. of the total. For such high grade stations, with thoroughly modern equipment, we should expect an investment cost of from $150 per kw. in the smaller, down to $100 per kw. in the larger sizes. In a few very large stations, the investment cost has been less than $100 per kw., but for stations under 10,000-kw., it very rarely occurs that the cost is below the above figure. The Ft. Wayne station is thus unique in having set a new standard for power station cost which may well be emulated in cases where turbine machinery is applicable. The following table shows the cost of the complete station, exclusive of substation apparatus, but including main line transformers — a total of $66.25 per kw. generating capacity.

## TABLE III.

COST OF COMPLETED POWER STATION.

8,500 KW.

*No Substation Apparatus.*

| | Cost. | Per Kw |
|---|---|---|
| *Building:* Including general concrete and steel work, galleries, coal bunker, smoke flue, condenser pit, coal storage pit, etc. | $93,217 | $10 97 |
| *Generating Plant:* Including turbines, generators, exciters, cables, switchboards, transformers and ventilating ducts | 259,711 | 30 55 |
| *Boiler Plant:* Including boilers, superheaters, stokers, piping, pumps, heaters, settings, breechings and tank | 118,313 | 13 92 |
| *Condenser Plant:* Including condensers, pumps, piping, free exhausts, water tunnels and intake screen | 33,790 | 3 98 |
| *Coal Handling Plant:* Including Gantry crane, crusher, motors and track | 7,990 | 0 94 |
| *Erection Superintendence, Engineering and Miscellaneous* | 50,500 | 5 94 |
| Total, excluding property and siding | $563,520 | $66 25 |

In this summary, the building cost is naturally high, owing to the large amount of structural material necessary. On the other hand, boiler and condenser costs are extremely low for reasons previously set forth.

Using as a basis the above costs and the rate of variation with loading factor already shown in curve form, Fig. 3, the ultimate total cost of power at different loading factors, may now be predicted; in other words, the total financial result of station operation. Fig. 17 has been prepared along these lines. Fixed charges are dealt with entirely above the horiontal line, and operating costs below. The total power cost, at a given loading factor, is then represented by the total vertical distance between the two outer curves. These fixed costs are based upon the following assumptions:

| | | |
|---|---|---|
| (a) | Bond interest and taxes | 7 per cent. |
| (b) | Sinking fund, equivalent to 6.53 per cent. depreciation* | 4.2 per cent. |
| (c) | Total fixed charges on capital cost | 11.2 per cent. |

---

* Depreciation determined by summing the depreciation on the several parts of the plant, as follows: Building, 3 per cent.; boiler plant and coal handling apparatus, 10 per cent.; condensing pant, 6 per cent.; generating plant, 7.5 per cent.; general average, 6.43 per cent.

From these curves, Fig. 17, the total cost of power at the present station loading factor, 24 per cent., is 0.85c. per kw-hour. At 33 per cent. loading factor, the total cost would be 0.62c. per kw-hour and at a possible loading factor of 50 per cent., 0.5c. per kw-hour. This, the author ventures to say, is a result which it will be difficult to duplicate in any station of expensive construction burning the medium grade of bituminous coal at reasonably near the same cost per ton It is the ultimate result that proves the correctness of the engineering principles involved in the design of the station.

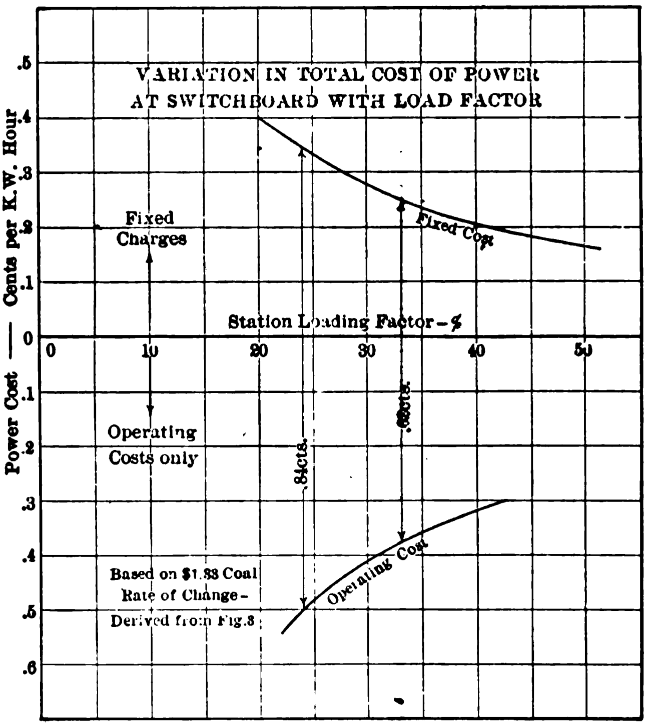

FIG. 17.— VARIATION IN POWER COST.

*Comparative Data.* As extreme compactness is one of the striking features of the Ft. Wayne station, it is instructive to note its relative position in this regard to other turbine stations, of both smaller and larger capacity, now in operation. To this end, Table No. IV (see Appendix B), and Fig. 18, have been prepared, the former comprising the principal data on the various stations. In the latter, the curves show principally the element of space occupied The lower curve represents net generating room area, exclusive of switchboard room; i. e., the actual space devoted to generating machinery and the necessary auxiliaries. It is instructive to observe that there is little to choose between the horizontal and vertical types of turbines, the facts pointing to the former if

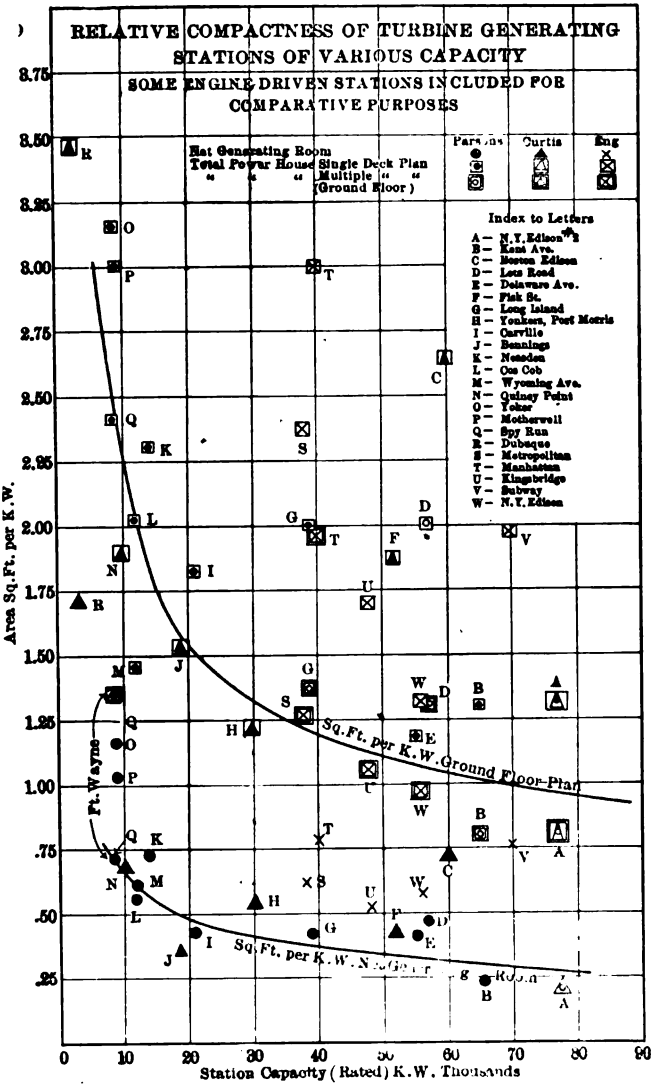

FIG. 18.— CURVES SHOWING RELATIVE SPACE OCCUPIED.

anything, as tending to secure the most compact construction. This is principally due to the fact that there is usually room for surface condensing apparatus directly beneath the turbine within the skeleton or structural foundations, while the vertical type turbine requires extra floor space for condensing apparatus and auxiliaries, except when sub-base condensers are used. Even then the advantage is not materially greater. For instance, the Bennings Station, Washington, which seems to be relatively the most compact of its kind using base condensers, appears on the plot as not materially lower than the average station; while, on the other hand, Boston Edison, containing the same type of condenser, appears to considerable disadvantage, largely owing to the arrangement of the boiler and auxiliary plants. In this comparison, the Ft. Wayne station easily approximates the average.

The second curve shows the relative ground floor area of the total plant as installed, whether single, double or triple-deck. Here a great discrepancy appears, owing to the wide difference in arrangement of boiler rooms. In this respect, the comparative data serves hardly more than a record. Here the Ft. Wayne station appears to the greatest advantage — showing the same relative compactness as stations some four or five times its capacity.

In many of these stations, economizers are provided for on the boiler floor; in others, on a separate floor or gallery above. Hence, comparison can best be made on a single-deck boiler or generating plant throughout. In the diagram, all of the multiple-deck plants are also designated on the single-deck basis, and the results are at wide variance. But here again the Ft. Wayne station compares favorably with stations many times its capacity, so that from all standpoints, the constructive scheme employed, seems well taken.

For purposes of comparison, a number of large engine-driven plants have been added to the diagram — Waterside station No. 2 appearing to be the most compact in spite of the triple-deck boiler room of the Metropolitan station.

In the matter of boiler capacity allotted to a given generating equipment, the comparative table shows general practice to average about 0.75 boiler h.p. per kw.— in some cases running as high as 1 bo. h.p. per kw., and as low as 0.6. In but one plant, however (Carville), is the ratio considerably below that at the Ft. Wayne station where the combined lighting and traction service occurs. To this, of course, may be attributed a large share of the cost reduction. From most standpoints, therefore, the station under description may be regarded as a distinct step forward in the field of electric power properties. It is, of course, possible that inherent defects will later develop, tending to offset the advantages otherwise secured, but experience alone will determine this definitely. Up to the present time no defects have appeared serious enough to occasion any fundamental change in plans, and the station may be regarded as an eminently successful experiment.

In closing, the author desires to acknowledge the courtesy and assistance of Mr. C. D. Emmons, General Manager of the Ft. Wayne & Wabash Valley Traction Co., and Mr. M. J. Kehoe, Superintendent of

Power, in the preparation of this paper, and for the opportunity to place before you the details of design and data on the cost and operation of the Spy Run Power Station.

## APPENDIX A.

### *Equipment Schedule.*

Railway system.— 3-phase, 25-cycle, 33,000 volts transmission, 550 volts d.c. distribution from power station and substations.

*Lighting System.*— 2-phase, 60-cycle, 2,300 volts.

*Heavy Power Service.*— 550 volts, d.c. from 60-cycle rotaries.

*Generating Units* (Westinghouse).— 2 1,500-kw., 3-phase, 25-cycle, 390-volt railway units — 37.5 kw., 125-volt exciter; 2 1,500-kw., 2-phase, 60-cycle, 2,300-volt lighting units; 37.5 kw., 125-volt exciter; 1 400-kw. railway unit, 10-kw. exciter; 1 500-kw. lighting unit, 10-kw. exciter.

*Boilers* (Babcock & Wilcox).— 10 400-h.p. water tube, inclined header type drums 42 by 23-in. 4-in. tubes, 16 sections, 12 high, 200-lb. pressure; internal type U-tube superheaters in first pass — 75° superheat.

*Condensers* (Buckley).— 4 pairs barometric jet for large units, 24-in. heads, 10-in. tail pipes; 1 7-in. and 1 8-in. single condenser for small units; no dry vacuum pumps.

*Pumps* (Boyts-Porter).— Boiler feed, 2 20 by 12 by 30 "Yough" outside packed plunger type; Condensers 4 20 by 36 by 48 inside packed plunger type for large units; 2 12 by 20 by 48 for small units. General service pumps, 1 10 by 12 by 18 "Yough," 1 8 by 12 by 17 by 10, Laidlaw-Dun-Gordon duplex-compound.

*Heaters* (Platt Iron Works).— Two units, in duplicate, open heater type, with automatic float valves.

*Steam Piping* (Pgh. Valve & Fdy. Co.).— Designed for 200-lb., long radius bends, extra heavy fittings flanged and peaned, corrugated copper gaskets, 2-in. 85% magnesia covering, 10-in. headers, 8-in. risers to turbines (5-in. for small machines), 6-in. feed water header.

*Chimney* (Alphons-Custodis).— 12 ft. diameter, 180 feet high, radial brick construction, rotary damper operated in connection with automatic damper regulator.

*Rotary Converters* (Westinghouse).— 2 500-kw., 3-phase, 25-cycle, for railway; 1 300-kw., 2-phase, 60-cycle for city power service, induction type starting motors.

*Transformers* (Westinghouse).— Railway, 7 375-kw. 390 33,000 volts (one for reserve). Power, 2 150-kw 2,300-390 volts.

*Switching Apparatus* (Westinghouse).— 390-volt, 3-phase, 25-cycle railway board, 33,000 volt high tension board with distant control circuit-breakers, fuses and protection apparatus; 2,300-volt, 2-phase, 60-cycle lighting board; 60-cycle rotary power board; 125-volt exciter board for both systems, automatic voltage regulator, independent feeder voltage regulators, main and auxiliary buses to the weighing tanks. Gland water correction was, therefore, eliminated. [illegible]

### *Results of Tests.*

The accompanying table comprises all results computed, not only for the test as actually run but also corrected to contract conditions. These corrections were mutually agreed upon previous to the test as representative of this type of turbine, and in the case of vacuum, embodied data previously obtained upon a turbine of similar design and nearly the same steam end capacity at the Manhattan station, New York:—

RESULTS OF TEST — NEW YORK EDISON TURBINE.

| Duration of test | As run under test conditions 9:30 A. M. to 5:30 P.M. | Corrected to contract conditions 9:30 A.M. to 5:30 P.M. | Corrected 6 hrs, 10:30 A.M. to 4:30 P.M. | Corrected 2 hrs. 1:30 P:M. to 3:30 P.M. |
|---|---|---|---|---|
| Average steam pressure lb. per sq. in......... | 177.50 | 175.00 | 175.00 | 175.00 |
| Average superheat deg. F. | 95.74 | 100.00 | 100.00 | 100.00 |
| Average vacuum in Hg.. | 27.31 | 28.00 | 28.00 | 28.00 |
| Average load, kw....... | 9,830.48 | 9,830.48 | 9,864.80 | 9,868.62 |
| Total net steam consumed, lb............ | 1,192,229.00 | 1,169,709.00 | ....... | ....... |
| Average water rate, lb. per kw-hr. ............ | 15.16 | 14.874 | 14.817 | 14.72 |
| Equivalent water rate lb. per b.h.p. hr.......... | 10.95 | 10.70 | 10.65 | 10.6 |

Referring now to the accompanying log, Fig. 2, you will find the results segregated into hourly periods for a check upon the average. It has been noted above that the load was lower during the first and last hours — particularly the latter; and this, together with the fact that heavy load had been on the machine only ten minutes before the start of the test, prompts an inquiry into the average results obtained for the middle six hours, as given in the table. For comparative interest, the best results for a period of two consecutive hours, are also given. This data indicates that the turbine gave on actual test, a water rate of 15.16-lb. per kw-hr. measured at the switchboard under conditions generally below contract conditions. Corrected to the latter, the average water rate is 14.874-lb. per kw-hr.; but for the six hour period noted above, the results are 14.817-lb. per kw-hr., equivalent to 10.65 per hr. b.h.p. hr. For the best hour the corrected results are 14.721-lb. per kw-hr., following an hour's run practically as good — 14,729-lb. per kw.-hour so that this turbine may be said to have developed a b.h.p. on 10.6-lb. of steam per hour, which is equivalent to 9.75-lb. per internal h.p.r., based upon measured no-load losses, as shown by the Manhattan turbine under test.

The best assurance of the accuracy of these tests is offered by the identical nature of the results as compared with the turbines of similar size and construction installed in the Manhattan station and the Long Island station of the Pennsylvania Railroad. Taking into consideration the specific operating conditions obtained during the test, I do not hesitate to state that as far as my knowledge of turbine practice in this country is concerned, these results represent the highest economy yet obtained from a steam turbine as a prime mover. In this I do not wish to be misunderstood. Almost as low a water rate, 11-lb. per b.h.p. hr. was obtained several years ago by Messrs. Deane and Main on a 400 k.w. Parsons machine of older design, but under high vacuum and superheat. These operating conditions have the most important bearing on all turbine economies, and due consideration should also be given thereto before any conclusions are drawn as to relative efficiency. In presenting these tests therefore I do so with the conviction that the New York Edison plant represents one or more steps forward in the advancement of the turbine art.

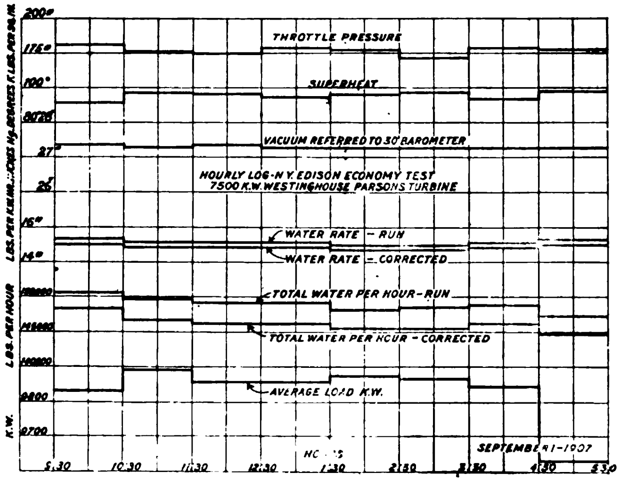

FIG. 2. HOURLY LOG. NEW YORK EDISON ECONOMY TEST.

MR. BIBBINS:—In regard to the possibilities of the double-deck station, page 291 of the paper, it is evident that the most important limitation is the grate surface that can be installed with any given girder span. In the Fort Wayne plant, four 200 h.p. boilers completely fill the 25-ft. spans between each pair of turbine columns. But, I desire to call your attention to the fact that fully 25 per cent. more boiler capacity could be installed in this same space if necessary, employing the same type of mechanical stoker and a reasonable ratio of grate to heating surface (1 to 50). To accommodate this increased capacity, a double tier boiler might prove most suitable. The problem thus involves three important variables — grate surface, span and height. As the last named factor offers the greatest latitude of design, this leads distinctly to double-ended furnace arrangement, the adoption of which greatly enlarges the scope and possibilities of double-decked power station construction.

Quite recently there became available the results of a very important test on one of the largest turbines built, and believing that the results would be of much interest in connection with this general subject, I am permitted by your president to present them supplementary to the paper.

President Adams:— This paper is a very exhaustive one, and it is in connection with a station that we have been looking to for a year or more, and we are very much indebted to Mr. Bibbins for presenting it in this manner. We could not do justice to the paper to attempt to discuss it in the time we have at our disposal. I regret exceedingly that we cannot do so, because I believe there are a number of gentlemen here who would like to pitch right in and have an animated discussion; but it is now 25 minutes past 5 and we have some little general business to clean up, and I think we had better pass on.

Mr. Evans:— I want the privilege of just saying one word in connection with Mr. Bibbins' paper. It occurs to me, Mr. President, that we have been very greatly handicapped at this meeting from the fact that the papers were not printed and distributed earlier, as it is certainly due Mr. Bibbins, who has no doubt given a great deal of time and attention to a paper of this character, to have it distributed sufficiently early so that we could all become familiar with it; and you can see that the way he was compelled to present this paper at this late hour in the day is not doing him justice. While I do not know it is exactly proper or right to take any action at this time, if the Chair will entertain a motion, I will offer as a resolution that all papers and printed matter to come before the next convention shall be printed and in the mail at least thirty days before the meeting of the convention.

Mr. Palmer:— I second the motion.

President Adams:— Is there any discussion upon that motion?

Mr. Evans:— In support of my motion I want to say that the 14th of September comes around the same as the 14th of October, and if it is known positively that the reports must be prepared by the 14th of August, I am quite sure that we can get the papers prepared quite as readily by the 14th of August as we can thirty days later; and I think we have been seriously handicapped.

Mr. Simmons:— I think Mr. Evans' motion can simply become effective in this association as a recommendation to the incoming executive committee, and as such I am strongly in favor of the motion, the executive committee, of course, taking action for the association on the matter. But the object of the motion, as I understand it, is to give the incoming executive committee, which is the governing body, an idea that that is the wish of the association.

(Motion unanimously carried.)

President Adams:— The next order of business, gentlemen, is general business. In this connection I just want to make one statement in reference to the matter that was brought up before the American Association this morning, at which time a resolution was presented to amend the by-laws, so that the past officers of the association should become honorary members of the executive committee. In looking this matter up to see how it affected our association, I found that our by-laws required that an amendment should be submitted to the members thirty days in advance, so that we will not be able to take action upon this question at this time. I will therefore leave the matter for the consideration of the incoming executive committee. Is there any other new business?

Mr. Palmer:— I observe that what seems to me to be a very important feature of the general scheme of electric railway engineering is, I might say, neglected. We have had papers on and given consideration to topics covering track, car houses and rolling stock, but we seem to have lost sight entirely of the means and methods by which the power generated in the stations is put out, and made use of in the cars. Now, the various problems of maintenance and construction of overhead lines are grave and serious. The amounts of capital invested in the lines are large. The Institute of Electrical Engineers considers this matter to be of such importance as to give very serious consideration to it. I want to suggest, Mr. President, that the executive committee in arranging the program for the coming convention be requested to have some papers prepared — and perhaps a question box — covering the topics I have indicated.

President Adams:— I think that is an excellent suggestion, Mr. Palmer, and if there is no objection we will let that matter go right through to the incoming executive committee. I desire to state, in connection with that same subject, that the executive committee, for the past two years at least were confronted with such a mass of work for this association to handle, that it was very difficult for it to weed out and get down to the absolutely essential subjects that were handled. That is a subject that has been somewhat neglected, and I believe the incoming executive committee will do well to give the matter their consideration. We have had a rather busy meeting, and when I tell you that we had several papers in addition to those that were scheduled to be brought up at this convention, you can appreciate what the executive committee had ahead of it this year. Is there any new business? If not, the next thing in order is the report of the Nominating Committee of which Mr. Clark is chairman.

Mr. Clark:— Gentlemen, I am going to present the following names as officers for the ensuing year, according to rank:

For President — F. G. Simmons, Superintendent of Construction and Maintenance of Way, The Milwaukee Electric Ry. & Light Co., Milwaukee, Wis.

For 1st Vice-President — Paul Winsor, Chief Engineer of Motive Power and Rolling Stock, Boston Elevated Railway Co., Boston, Mass.

For 2d Vice-President — F. H. Lincoln, Assistant General Manager, Philadelphia Rapid Transit Co., Philadelphia, Pa.

For 3d Vice-President — W. H. Evans, Master Mechanic, International Railway Co., Buffalo, N. Y.

For Secretary and Treasurer — John W. Corning, Electrical Engineer, Boston Elevated Railway Co., Boston, Mass.

For Members of the Executive Committee — The officers and W. J. Harvie, Chief Engineer, Utica & Mohawk Valley Railway Co., Utica, N. Y.; William Roberts, Superintendent of Motive Power, Northern Ohio Traction & Light Co., Akron, O.; E. O. Ackerman, Engineer, Maintenance of Way, Columbus Railway & Light Co., Columbus, O.; John Z. Murphy, Electrical Engineer, Chicago Union Traction Co., Chicago, Ill.

MR. OLDS:— Mr. President, I move you that the secretary be instructed to cast a ballot for the officers as nominated by our committee and for a resolution tendering the committee a vote of thanks.

(Motion seconded and unanimously carried.)

PRESIDENT ADAMS:— Gentlemen, before turning over this chair to Mr. Simmons, I want to take this opportunity of thanking you for the support that I have received as your presiding officer for the past two years. It has been this support that has brought forth meetings such as we have had here at this convention. The executive committee for the past year has stood behind me and supported me to the last ditch. I can only say I thank the members from my whole heart. I want to say a word in reference to our retiring secretary. He has been with us since the association was organized in Detroit, and he has stood by us and given his untiring efforts to the work of the association, and we appreciate it very much. Gentlemen, I now take the greatest pleasure in introducing to you Mr. Simmons, your new president.

PRESIDENT-ELECT SIMMONS:— President Adams and members of the Association: The hour is late and it is not my intention to consume any great amount of time in making a speech of acceptance. I think it will be probably sufficient for me to say that it is impossible for me to express the feeling that I have in the matter. The honor conferred on me is certainly beyond my deserts, accorded me through good fellowship by the gentlemen I have been working with; but I assure you I will do all in my power during my incumbency of this office, to promote the best interests of this association, which I assume to be the intent of every officer-elect. We are just coming out of a period of trials and troubles in reorganization, the reorganization of the main association, and the extension of the scope of our own association; and during these entire two years the burden has been borne, assisted by the other officers of the association, by our worthy past president, Mr. Adams, and I want to say at this time that I don't believe we have had in the ranks of this organization any one man that could have carried the matters that developed and devolved upon him through to so successful an issue, certainly no one who could have done it with any better degree of ability, patience, and untiring energy; and I believe that the thanks of the association and of the incoming officers are due to Mr. Adams to the fullest extent.

Mr. Mower, our retiring secretary, has, as Mr. Adams stated, been with us since the organization of the association on a very small scale in the city of Detroit, and Mr. Mower's work has been untiring and persevering. We all feel under a debt of gratitude to Mr. Mower, and the incoming officers, I am sure, can only promise that they will endeavor to carry things forward, now that they are in full swing, with their utmost effort and with the best ability that lies in them. Our newly elected first vice-president, Mr. Winsor, is unfortunately detained in Boston; Mr. Fred Lincoln, of Philadelphia, had to go back there on account of stress of work; our third vice-president, Mr. W. H. Evans, is with us, and I am sure you would be glad to hear from him.

Mr. Evans:— I hardly feel that I should take the time at this late hour to say anything. I assure the association that I very much appreciate the high honor of serving among its executive officers, and I shall do all that I can in my humble way to further the interests of the association in every way possible, and I trust that not only the administration of the incoming president, but of our subsequent presidents will, if I may say, equal or surpass that of the retiring president;

and while I have the floor I want to add a word of commendation of Mr. Adams' untiring efforts in connection with the work of this association, as I personally know, for the past two years and more particularly within the last portion of this year, when I have had the chairmanship of the Committee on Standardization, Mr. Adams has attended all of the meetings, and not only lent his presence, but took a very active and energetic part in the deliberations of the committee, and when you take that into consideration with the numerous other demands which must have had claim on his time, Mr. Adams must have made a very considerable sacrifice in the interests of this association in the last two years. I thank you, gentlemen.

President-Elect Simmons:— Gentlemen, before closing, I believe that our ex-president, Mr. Olds, has a matter which he wishes to bring up.

Mr. Olds:— Mr. Adams, our retiring president, it gives me great pleasure to be called upon at this time to say a few words to you. It is but a few years ago that a few of us gathered together in organizing this association. You have been and are one of us. Through your untiring efforts we are able to-day to see an association, and to take part in one, that is second to none in this country or any other. Your work during the past two years that the reorganization has been going on has been grand. It has really exceeded the hopes of the most sanguine of us, and I feel and know that our success to-day is due to a very great extent to your untiring efforts. To-day there was a little matter came up among the boys who thought they would like to remember you with a little present. Something that you could keep to remember our association, to remember the boys that have stood around you, and tried to be guided and do the best they could in their weak way, and we have chosen this clock as the article. I present it to you not only with my own best wishes, but the best wishes of all and God speed to you in your future work, and I know that we shall be able and also expect to find you active as one who is always ready and willing to do his part.

Mr. Roberts:— Mr. President, I have been requested to say a few words. I feel, after the eloquence of Mr. Olds, like breaking into poetry. I remember the old lines:

> "Were I so tall as to grasp the Pole,
> Or reach the ocean in my span,
> I must be measured by my soul,
> The mind is the standard of the man."

After the way these meetings have been conducted, and the very genial and smiling way in which you have met all the difficulties and made for us a very enjoyable time, my heart warms towards you, and I echo the words that have been used by Mr. Olds. I was quite amused when I saw your face when you saw that parcel come on the table. It reminded me of something I saw in *Judge* the other day about an old farmer who went to New York. He never knew anything about telephones. He sat down in his friend's house and looked around and saw two, and he said, "You have got those things here, have you?" and his friend said "Yes, did you ever use a telephone?" The old farmer said "No." His friend said, "Anybody live around you where they have a telephone?" "Yes," said the farmer, "a fellow lives about three or four acres down from my house." "Well," said his friend, "why don't you call him up now and get your wife to talk to you." You will be astounded. "Oh, no," said the farmer, "you don't know Jane." "Well," said his friend, "never mind, get her over; she will like to come over." "Don't do that," said the farmer. "I will," said his friend, and he called this man's wife up. Then a little electric storm started up, and the wires got crossed, and his friend said, "Here is your wife." An just then a severe crash of lightning came and hit him on the back, and he said, "That's Jane, all right." I thought of that little story when I saw the surprise upon your face, Mr. President. It is said that the man is a blessing to the human race who can make two blades of grass grow where one grew before; and the amount of work that you have done entitles you to our profound respect and admiration. It gives me very great pleasure to echo the sentiments of Mr. Olds. I trust that you shall live for many years and enjoy our fellowship, and that we may enjoy yours. That little memento is given to you as a reminder of our feelings toward you.

Mr. Baker:—I don't think I can frame at the present time the words I would like to use to express my feelings toward Mr. Adams. I know that he not only has worked hard during the last two years, but in the year 1905, while I was president of the association, I delegated a great deal of the work to him in connection with the reorganization, feeling that he was to be the next gentleman to fill the chair. The organization as it stands, together with its relations to other associations, is largely due to the work of Mr. Adams. I don't like to say any more, as it is getting late. I thank you.

President-Elect Simmons:—I want to explain to you all that when this matter came up recently, in an effort to get a fitting present, it was decided to get a clock, and in canvassing Atlantic City we found that it was not possible to secure one of sufficient merit, or sufficiently ornate to fill the bill, so that the present clock presented to Mr. Adams simply represents what we wanted to do, and a much more elegant one will be at hand.

President Adams:—Gentlemen, I am very thankful for the story Mr. Roberts has told us; also for the other kind remarks which have been made; as I have been able to recover somewhat from the great surprise you have sprung upon me.

This gift I shall always prize as a token of your esteem and I assure you it will always occupy a place where it will constantly remind me of this occasion and of the true and loyal friends I have made in this association since its organization, and from my heart I thank you.

The work that I have done in connection with this organization has come from the bottom of my heart; I have been in sympathy with all the moves that have been made in the past and I felt from the start that the organization was one that should go forward and it has been my aim to push forward and place the association upon the ground that it should occupy.

In turning this work over to Mr. Simmons, I do so with the feeling that we are in a position to still further advance the standard of the organization and I believe that he is the man best fitted to take up the work at this point.

It has been a great pleasure for me to have been able to direct the work for the past two years. Gentlemen, I thank you.

Mr. Fairchild:— I think as long as the incoming secretary and treasurer of the association is here in person the chair should introduce Mr. Corning to the meeting.

President-Elect Simmons:— It affords me great pleasure in calling upon Mr. Corning, of Boston. If he will come up to his natural place we would be glad to hear from him.

Mr. Corning:— Mr. President, Mr. Retiring President, and gentlemen of the association: I wish that I were such a happy and facile speaker as those I have heard here since my attendance at the convention; but I am not; and the only thing that I can say is that I appreciate very much the honor which you have conferred upon me in electing me secretary and treasurer of the Engineering Association. I will do all in my power to further the interests of the association, and put my best efforts into the work. I thank you very much for your kindness.

President-Elect Simmons:—Before the adjournment I wish to say that I would like to have a meeting of all the members of the executive committee at the Dennis Hotel to-morrow morning at 9:30, and we would like to have, in connection therewith, our retiring president, Mr. Adams, and our retiring secretary and treasurer, Mr. Mower.

The meeting then adjourned, *sine die.*

# CONSTITUTION AND BY-LAWS

OF THE

# AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION.

## CONSTITUTION.

### *Name.*

I. The name of this association shall be the "American Street and Interurban Railway Engineering Association," and its office shall be at the place where the secretary resides.

### *Objects.*

II. The objects of this association shall be to bring together those engaged in street and interurban railway engineering, for the interchange of ideas; to acquire and distribute information, and to promote uniformity of practice.

### *Members.*

III. The membership of this association shall consist of two classes, as follows:

(a) Active members, consisting of active members of the American Street and Interurban Railway Association. Each active member shall be entitled to one vote on all questions coming before this association, which shall be cast by a properly accredited representative of its mechanical, electrical, way, or engineering departments. Each active member shall send as many delegates from the engineering departments as it may desire.

(b) Associate members, consisting of associate members of the American Street and Interurban Railway Association, who may elect to ally themselves with this association.

### *Amendment.*

IV. This constitution may be amended by a two-thirds vote of the members present at a regular meeting, provided the proposed amendment shall have the approval of two-thirds of the executive committee, and provided also that a copy shall have been sent to each of the active members, at least thirty days prior to the date of the meeting at which the proposed amendment is to be acted upon.

## BY-LAWS.

### *Officers and Executive Committee.*

I. The officers shall consist of a president, three vice-presidents, a secretary and treasurer, and four others, who shall constitute the executive committee. The executive committee shall have the entire charge and management of the affairs of the association. The officers and executive committee shall be elected by ballot at each annual meeting of the association, and shall hold office until their successors shall be elected. The officers of this association shall be chosen from the mechanical, electrical, way, or engineering departments of active members. The duties of secretary and treasurer shall be performed by the same person.

### *Duties of Officers.*

II. The officers of the association shall assume their duties immediately after the close of the meeting at which they are elected. They shall hold meetings at the call of the president, or, in his absence, at the call of the vice-presidents, in their order, and make arrangements for carrying out the objects of the association. In case of resignation or death of an officer or a member of the executive committee, the vacancy may be filled for the unexpired term by the executive committee.

### *President.*

III. The president shall be the chief executive officer of the association. The president, if present, or in his absence one of the vice-presidents, in their order, if present, shall preside at all meetings of the association, and of the executive committee, and shall represent this association on the executive committee of the American Street and Interurban Railway Association.

### *Secretary and Treasurer.*

IV. The duties of the secretary and treasurer shall be as follows:

(a) To receive and safely keep all moneys of the association, to keep correct accounts of the same, and to pay all bills approved by the president. He shall make an annual report to be submitted to the association. He shall give a bond to the president in such a sum and with such sureties as shall be approved by the executive committee. He shall be paid a salary fixed by the executive committee.

(b) To take minutes of all the proceedings of the association and of the executive committee, and to enter them in books kept for the purpose.

(c) To conduct the correspondence of the association.

(d) To read minutes and notices at all meetings, and to present papers and communications, if the authors wish it.

(e) To collect and file for the benefit of the members information regarding matters relating to the purposes of the association.

(f) To attend to the publication of the proceedings of this association in connection with the secretary of the American Street and Interurban Railway Association.

(g) To send notices to all members of the association at least thirty days before each meeting, mentioning papers to be read, and any special business to be brought before the meeting.

(h) To perform such other duties as may be required of him by the constitution and by-laws, and such duties as may be assigned him by the executive committee.

### *Executive Committee.*

V. (a) The executive committee shall hold a regular meeting before each regular annual meeting of the association, and shall hold such special meetings as may be necessary. Such special meetings may be called by the president, or any five members of the executive committee. A majority of the members of the executive committee shall constitute a quorum at all meetings. A vote of the executive committee may be taken by mail when deemed necessary by the president.

(b) The secretary shall give such reasonable notice of all meetings as the committee shall by vote prescribe, and all such notices shall, as far as practicable, specify the business to be brought to the attention of the committee at such meetings.

(c) The executive committee shall present a report to each regular annual meeting of the association, and shall include in such report the names of the members elected during the year, and its recommendations for the future work of the association.

### *Meetings.*

VI. The regular annual meeting of this association shall convene at a time and place to be approved by the executive committee. Special meetings may be held upon the order of the executive committee. Notice of every meeting shall be given by the secretary in a circular addressed to the members at least thirty days before the time of meeting. Fifteen members shall constitute a quorum at any meeting.

### *Order of Business.*

VII. At the regular meeting of the association the order of business shall be:

1. Reading of the minutes of the last meeting.
2. Address of the president.
3. Report of the executive committee.
4. Report of the secretary and treasurer.
5. Reports of special committees.
6. Reading and discussion of papers.
7. General business.
8. Election of officers.

At other general meetings of the association the order of business shall be the same, except as to the third, fourth and eighth clauses.

### *Voting.*

VIII. All votes, except as herein otherwise provided, shall be *viva voce,* or by ballot upon the request of any member, and in the case of a tie, the presiding officer shall vote.

### *Reading of Papers.*

IX. All papers read at the meetings of the association must relate to matters connected with the objects of the association, and must have the approval of the executive committee before being read. Persons to whom subjects are assigned, must signify in writing their intention to prepare the paper, and forward it to the secretary at least sixty days previous to the date of the meeting.

### *Papers, Illustrations and Models.*

X. All papers, illustrations and models submitted to the meeting of the association shall remain the property of the owners; subject, however, to retention by the executive committee for examination and use, but at the owner's risk.

### *Rules of Order.*

XI. All rules not provided for in these by-laws shall be those found in " Roberts' Rules of Order."

### *Amendment.*

XII. Notice of all propositions for adding to or altering any of these by-laws shall be given to the members of the association, at least thirty days before the meeting at which they are to be acted upon.

### *Copy of Constitution and By-Laws.*

XIII. Each member of the association shall be furnished by the secretary with a copy of the constitution and by-laws of the association and also a list of the members.

## MEMBER COMPANIES AND THEIR ENGINEERING OFFICERS

(Arranged alphabetically according to the names of companies.)

ALBANY & HUDSON RAILROAD Co., Hudson, N. Y.,
R. P. Leavitt, Mechanical Inspector.

ALTOONA & LOGAN VALLEY ELECTRIC RY. Co., Altoona, Pa.,
A. S. Kibbe, Chief Engineer.

ANDERSON TRACTION Co., Anderson, S. C.,
J. E. Sirriul, Electrical Engineer.

ANNISTON ELECTRIC & GAS Co., Anniston, Ala.,
W. C. Reid, Chief Engineer.

ASHEVILLE ELECTRIC Co., Asheville, N. C.,
H. W. Plummer, General Manager.

ATLANTIC COAST ELECTRIC RAILWAY Co., Asbury Park, N. J.,
S. F. Hazelrigg, General Manager.

ATLANTIC SHORE LINE RAILWAY Co., Sanford, Me.,
S. E. Woodbury, Chief Engineer.

AUGUSTA & AIKEN RAILWAY Co., Augusta, Ga.,
J. A. Wells, Chief Engineer.

AURORA, ELGIN & CHICAGO RAILROAD Co., Wheaton, Ill.,
Charles Jones, Chief Engineer.

AUSTIN ELECTRIC RAILWAY Co., Austin, Tex.,
J. M. Aday, Chief Engineer.

BANGOR RAILWAY & ELECTRIC Co., Bangor, Me.,
C. M. Tolman, Chief Engineer.

BAY CITY TRACTION & ELECTRIC Co., Saginaw, Mich.,
S. E. Wolff, General Manager.

BEAUMONT TRACTION Co., Beaumont, Tex.,
C. A. Rhymes, Chief Engineer.

BENTON HARBOR-ST. JOE RAILWAY & LIGHT Co.,
St. Joseph, Mich.,
H. C. Mason, General Manager.

BINGHAMTON RAILWAY Co., Binghamton, N. Y.,
J. H. Cole, Chief Engineer.

BIRMINGHAM RAILWAY, LIGHT & POWER Co.,
Birmingham, Ala.,
Geo. H. Harris, Superintendent Electric Department.

BOSTON & MAINE RAILROAD Co.,
(Concord & Manchester Electric Branch, Concord, N. H.),
F. D. Hall, Chief Electrician.

BOSTON & NORTHERN STREET RAILWAY Co., Boston, Mass.
C. F. Bancroft, Superintendent Motive Power.

BOSTON & WORCESTER STREET RAILWAY Co.,
South Framingham, Mass.,
E. H. Rogers, Chief Engineer.

BOSTON ELEVATED RAILWAY Co., Boston, Mass.,
Paul Winsor, Chief Engineer Motive Power and Rolling Stock

BRIDGETON & MILLVILLE TRACTION Co., Bridgeton, N. J.,
A. S. Kibbe, Chief Engineer.

BROCKTON & PLYMOUTH STREET RAILWAY Co.,
Plymouth, Mass.,
W. R. Morton, Chief Engineer.

BUFFALO & LAKE ERIE TRACTION Co., Buffalo, N. Y.,
A. R. Myers, Electrical Engineer.

BUTTE ELECTRIC RAILWAY Co., Butte, Mont.,
J. R. Wharton, General Manager.

CALUMET ELECTRIC STREET RAILWAY Co., Chicago, Ill.,
C. J. Blanchard, Chief Engineer.

CAMDEN INTERSTATE RAILWAY Co., Huntington, W. Va.,
James Fagan, Chief Engineer.

CAPITAL TRACTION Co., Washington, D. C.,
D. S. Carll, Chief Engineer.

CEDAR RAPIDS & IOWA CITY RAILWAY & LIGHT Co.,
Cedar Rapids, Iowa,
W. J. Greene, Electrical Engineer.

CENTRAL PENNSYLVANIA TRACTION Co., Harrisburg, Pa.,
J. L. Sheppard, Chief Engineer.

CHARLESTON CONSOLIDATED RAILWAY, GAS & ELECTRIC Co.,
Charleston, S. C., .
W. W. Fuller, Chief Electrician.

CHARLOTTE ELECTRIC RAILWAY, LIGHT & POWER Co.,
Charlotte, N. C.,
R. L. Wommack, Chief Engineer.

CHICAGO & JOLIET ELECTRIC RAILWAY Co., Joliet, Ill.,
A. S. Kibbe, Chief Engineer.

CHICAGO & MILWAUKEE ELECTRIC RAILROAD Co., Chicago, Ill.,
F. J. Geraghty, Chief Engineer.

CHICAGO CITY RAILWAY Co., Chicago, Ill.,
H. B. Fleming, Superintendent of Way.

CHICAGO UNION TRACTION Co., Chicago, Ill.,
J. Z. Murphy, Chief Engineer.

CHILLICOTHE ELECTRIC RAILROAD, LIGHT & POWER Co.,
Chillicothe, O.
Charles Waymier, Chief Engineer.

Cincinnati Traction Co., Cincinnati, O.,
Herbert McNulta, Chief Engineer.

Citizens' Electric Co., Eureka Springs, Ark.,
M. D. Jordan, General Manager.

Citizens' Electric Street Railway Co.,
Newburyport, Mass.,
O. F. Files, General Superintendent.

Cleveland Electric Railway Co., Cleveland, Ohio,
E. J. Cook, Chief Engineer.

Cleveland, Painesville & Eastern Railroad Co.,
Willoughby, Ohio,
J. Jordan, General Manager.

Cleveland, Southwestern & Columbus Railway Co.,
Cleveland, O.
E. G. Hindert, Chief Engineer.

Colorado Springs & Interurban Railway Co.,
Colorado Springs, Colo.,
C. E. Bibb, Chief Engineer.

Columbus, Delaware & Marion Railway Co.,
Columbus, O.
George Whysall, General Manager, Marion, O.

Columbus, New Albany & Johnstown Traction Co.,
Columbus, O.
F. A. Little, Chief Engineer.

Columbus Railroad Co., Columbus, Ga.,
John Cameron, Superintendent of Transportation.

Columbus Railway & Light Co., Columbus, O.,
F. R. Brosius, Chief Engineer of Power.

CONCORD, MAYNARD & HUDSON STREET RAILWAY CO.,
Maynard, Mass.,
F. W. Gray, Chief Electrician.

CONNECTICUT COMPANY (THE), New Haven, Conn.,
M. T. Rider, Chief Engineer.

CONSOLIDATED RAILWAYS, LIGHT & POWER CO. (THE),
Wilmington, N. C.,
R. MacRae, Chief Engineer.

DALLAS CONSOLIDATED ELECTRIC STREET RAILWAY CO.,
Dallas, Texas,
A. U. Smith, Engineer.

DANBURY & BETHEL STREET RAILWAY CO., Danbury, Conn.,
John Walters, Chief Engineer.

DAYTON & TROY ELECTRIC RAILWAY CO., Dayton, O.,
C. Evans, Engineer Power Station.

DAYTON & XENIA TRANSIT CO., Dayton, O.,
J. R. W. Gregg, Electrical Engineer.

DAYTON, COVINGTON & PIQUA TRACTION CO.,
West Milton, O.,
H. E. Cecil, Chief Engineer.

DEKALB-SYCAMORE & INTERURBAN TRACTION CO.,
DeKalb, Ill.,
H. L. Warne, Chief Engineer.

DENISON & SHERMAN RAILWAY CO., Denison, Tex.,
J. P. Crerar, President.

DENVER CITY TRAMWAY CO., Denver, Colo.,
C. A. Trease, Chief Engineer.

DES MOINES CITY RAILWAY CO., Des Moines, Ia.,
Frank S. Cummins, Chief Engineer.

DETROIT UNITED RAILWAY, Detroit, Mich.,
Sylvester Potter, Master Mechanic.

DULUTH STREET RAILWAY CO., Duluth, Minn.,
John Carson, Chief Engineer.

EAST LIVERPOOL TRACTION & LIGHT CO., East Liverpool, O.,
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EASTON TRANSIT CO., Easton, Pa.,
G. E. Jenkins, Engineer of Way.

EAST ST. LOUIS & SUBURBAN RAILWAY CO., E. St. Louis, Ill.,
L. C. Haynes, Vice-President.

EASTERN WISCONSIN RAILWAY & LIGHT CO.,
Fond du Lac, Wis.,
S. W. Marty, Chief Engineer.

ELGIN & BELVIDERE ELECTRIC CO., Chicago., Ill.,
W. L. Arnold, General Manager.

ELMIRA WATER, LIGHT & RAILROAD CO., Elmira, N. Y.,
W. W. Cole, General Manager.

EL PASO ELECTRIC RAILWAY CO., El Paso, Tex.,
C. H. Courser, Chief Engineer.

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D. G. Nelligan, Engineer of Way.

EVANSVILLE & EASTERN ELECTRIC RAILWAY CO.,
Evansville, Ind.,
H. C. Batlin, Chief Engineer.

EVANSVILLE ELECTRIC RAILWAY CO., Evansville, Ind.,
R. H. Cole, Chief Engineer.

FAIRMONT & CLARKSBURG TRACTION CO., Fairmont, W. Va.,
A. J. Purington, General Manager.

FARMINGTON STREET RAILWAY CO., Hartford, Conn.,
L. Gorry, Electrical Engineer.

FISHKILL ELECTRIC RAILWAY CO., Fishkill-on-Hudson, N. Y.,
John T. Smith, General Manager.

FITCHBURG & LEOMINSTER STREET RAILWAY CO.,
Fitchburg, Mass.,
Gus L. Enfors, Superintendent of Motive Power.

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A. W. Fishbaugh, Chief Engineer.

FORT WAYNE & WABASH VALLEY TRACTION CO.,
Fort Wayne, Ind.,
H. L. Weber, Chief Engineer.

FRIES MANUFACTURING & POWER CO., Winston-Salem, N. C.,
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GALESBURG & KEWANEE ELECTRIC RAILWAY CO.,
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GALVESTON ELECTRIC CO., Galveston, Tex.,
F. J. Bennett, Jr., Chief Engineer.

GARDNER, WESTMINSTER & FITCHBURG STREET RAILWAY CO.,
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E. Rumery, Chief Engineer.

GEORGIA RAILWAY & ELECTRIC CO., Atlanta, Ga.,
S. A. Redding, Electrical Engineer.

GRAND RAPIDS, HOLLAND & CHICAGO RAILWAY CO.,
Holland, Mich.,
Strathearn Hendrie, General Manager.

GRAND RAPIDS RAILWAY Co., Grand Rapids, Mich.,
A. C. Ogilby, Chief Engineer.

GREAT FALLS STREET RAILWAY Co., Great Falls, Mont.,
G. H. Jay, Electrical Engineer.

GROTON & STONINGTON STREET RAILWAY Co., Mystic, Conn.,
John B. Crawford, General Manager.

HARTFORD & SPRINGFIELD STREET RAILWAY Co.,
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Wm. Young, Chief Engineer.

HELENA LIGHT & RAILWAY Co., Helena, Mont.,
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HOUSTON ELECTRIC Co., Houston, Texas,
Flint McGregor, Engineer.

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INDIANA UNION TRACTION Co., Anderson, Ind.,
R. C. Taylor, Mechanical Engineer.

INDIANAPOLIS & CINCINNATI TRACTION Co., Indianapolis, Ind.,
J. W. Moore, Chief Engineer.

INDIANAPOLIS, COLUMBUS & SOUTHERN TRACTION Co.,
Columbus, Ind.,
Levi Crater, Chief Engineer.

INDIANAPOLIS TRACTION & TERMINAL Co., Indianapolis, Ind.,
Thos. B. McMath, Mechanical Engineer.

INTERNATIONAL RAILWAY Co., Buffalo, N. Y.,
Thomas W. Wilson, Engineer.

INTER-URBAN RAILWAY Co., Des Moines, Ia.,
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IOWA & ILLINOIS RAILWAY Co., Clinton, Ia.,
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JACKSON CONSOLIDATED TRACTION Co., Jackson, Mich.,
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KANSAS CITY-WESTERN RAILWAY Co. (THE),
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P. H. Palmer, Electrical Engineer.

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LEHIGH VALLEY TRANSIT CO., Allentown, Pa.,
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Geo. MacLeod, Chief Engineer.

LIMA & TOLEDO TRACTION CO., Lima, O.,
Thos. Elliott, Electrical Engineer.

LITTLE ROCK RAILWAY & ELECTRIC CO., Little Rock, Ark.,
R. F. Baise, Chief Engineer.

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Long Island City, N. Y.,
J. R. Savage, Chief Engineer.

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C. M. Johnson, Chief Engineer.

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Percival Moore, Vice-President and General Manager.

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R. W. Waite, Vice-President.

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F. H. Miller, Chief Engineer.

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A. J. Kohler, Chief Engineer.

MAHONING & SHENANGO RAILWAY & LIGHT CO.,
New Castle, Pa.,
M. E. McCaskey, General Manager.

MANILA ELECTRIC RAILROAD & LIGHT CO., Manila, P. I
C. P. Graves, General Manager.

MASON CITY & CLEAR LAKE RAILWAY CO., Mason City, Ia.,
J. H. Lary, Chief Engineer.

MEMPHIS STREET RAILWAY CO. (THE), Memphis, Tenn.,
G. B. Cornell, Chief Engineer.

MENOMINEE & MARINETTE LIGHT & TRACTION CO.,
Menominee, Mich.,
Edw. Daniell, General Manager.

MERIDIAN LIGHT & RAILWAY CO., Meridian, Miss.,
F. L. Bailey, Chief Engineer.

MEXICO ELECTRIC TRAMWAYS, LIMITED, City of Mexico, Mex.,
P. H. Evans, Chief Engineer.

MICHIGAN UNITED RAILWAYS CO., Lansing, Mich.,
James R. Elliott Vice-President.

MILFORD & UXBRIDGE STREET RAILWAY CO., Milford, Mass.,
F. M. Daniels, Chief Engineer.

MILLVILE TRACTION CO., Millvile, N. J.,
Daniel C. Lewis, General Manager.

MILWAUKEE ELECTRIC RAILWAY & LIGHT CO., THE,
Milwaukee, Wis.,
E. W. Olds, Superintendent of Rolling Stock.

MOBILE LIGHT & RAILROAD CO., Mobile, Ala.,
J. H. Wilson, General Manager.

MONTREAL STREET RAILWAY CO., Montreal, Quebec,
Patrick Dubee, Secretary.

NAHANT & LYNN STREET RAILWAY CO., Lynn, Mass.,
J. E. Dozier, General Manager.

NASHVILLE RAILWAY & LIGHT CO., Nashville, Tenn.,
W. G. Cameron, Chief Engineer.

NEW HAMPSHIRE ELECTRIC RAILWAYS, Haverhill, Mass.,
G. C. Pike, Chief Engineer.

NEW JERSEY & HUDSON RIVER RAILWAY & FERRY CO.,
Edgewater, N. J.
A. B. Snook, Chief Engineer.

NEW ORLEANS RAILWAY & LIGHT CO., New Orleans, La.,
E. B. McKinney, Chief Engineer.

NEWPORT NEWS & OLD POINT RAILWAY & ELECTRIC CO.,
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E. W. Norris, Chief Engineer.

NEWTON & BOSTON STREET RAILWAY CO., Newtonville, Mass.,
Mathew C. Brush, General Manager

NEW YORK & PORT CHESTER RAILROAD CO., New York, N. Y.,
C. O. Mailloux, Chief Engineer.

NEW YORK & QUEENS COUNTY RAILWAY CO.,
Long Island City, N. Y.,
C. S. Banghart, Master Mechanic.

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NEW YORK CITY RAILWAY CO., New York, N. Y.,
M. G. Starrett, Consulting Engineer.

NORFOLK RAILWAY & LIGHT CO., Norfolk, Va.,
E. S. Ely, Chief Engineer.

NORTHAMPTON TRACTION CO., Easton, Pa.,
Erwin Judd, Chief Engineer.

NORTHERN INDIANA RAILWAY CO., South Bend, Ind.,
J. McM. Smith, General Manager.

NORTHERN OHIO TRACTION & LIGHT CO., Akron, O.,
R. Trumbull, Chief Engineer.

NORTHERN TEXAS TRACTION CO., Fort Worth, Tex.,
H. M. Flanders, Chief Engineer.

OHIO RIVER ELECTRIC RAILWAY & POWER CO., Pomeroy, O.,
J. B. MacAfee, General Manager.

OKLAHOMA CITY RAILWAY CO., Oklahoma City, Okla.,
Henry M. Brauer, Secretary.

OLYMPIA LIGHT & POWER CO., Olympia, Wash.,
L. B. Faulkner, Manager.

OMAHA & COUNCIL BLUFFS STREET RAILWAY CO.,
Omaha, Neb.,
H. B. Noyes, Chief Engineer.

OMAHA, LINCOLN & BEATRICE RAILWAY CO., Lincoln, Neb.,
E. C. Hurd, Secretary.

OTTAWA ELECTRIC RAILWAY CO., Ottawa, Can.,
J. D. Fraser, Secretary.

OWOSSO & CORUNNA ELECTRIC CO., Owosso, Mich.,
Lawrence Manning, General Manager.

PACIFIC TRACTION CO., Tacoma, Wash.,
L. A. Nicholson, Chief Engineer.

PADUCAH TRACTION CO., THE, Paducah, Ky.,
H. C. Foss, Chief Engineer.

PENSACOLA ELECTRIC CO., Pensacola, Fla.,
John W. Leadley, Manager.

PEOPLES' RAILWAY CO. (THE), Dayton, Ohio,
A. S. Kibbe, Chief Engineer.

PETALUMA & SANTA ROSA RAILWAY CO., Petaluma, Cal.,
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PETERBOROUGH RADIAL RAILWAY CO. (THE),
Peterborough, Ontario,
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PHILADELPHIA & WEST CHESTER TRACTION CO.,
Philadelphia, Pa.,
W. A. Hall, Chief Engineer.

PHILADELPHIA & WESTERN RAILWAY CO.,
C. C. Long. Electrical Engineer.

PHILADELPHIA RAPID TRANSIT CO., Philadelphia, Pa.,
William S. Twining, Chief Engineer.

PITTSBURG & BUTLER STREET RAILWAY CO., Butler, Pa.,
L. H. Kidder, Electrical Engineer.

PORTLAND RAILROAD CO., Portland, Me.,
W. E. Knowlton, Chief Engineer.

PORTLAND RAILWAY CO., Portland, Oregon,
F. I. Fuller, General Manager.

PORTSMOUTH, DOVER & YORK STREET RAILWAY CO.,
Portsmouth, N. H.,
S. E. Woodbury, Engineer.

POTTSVILLE UNION TRACTION CO., Pottsville, Pa.,
E. W. Gough, Electrical Engineer.

POUGHKEEPSIE CITY & WAPPINGERS FALLS ELECTRIC
RAILWAY CO., Poughkeepsie, N. Y.
J. W. Hinkley, Jr., President.

PROVIDENCE & DANIELSON RAILWAY CO., Providence, R. I.
J. E. Thielsen, General Superintendent.

PUBLIC SERVICE RAILWAY CO., Newark, N. J.,
Martin Schreiber, Engineer M. of W.

PUEBLO & SUBURBAN TRACTION & LIGHTING CO.,
Pueblo, Colo.,
V. R. Hughes, Chief Engineer.

QUINCY HORSE RAILWAY & CARRYING CO., Quincy, Ill.,
C. H. Gibbs, Chief Engineer.

RALEIGH ELECTRIC CO., Raleigh, N. C.,
H. C. Taylor, Chief Engineer.

RHODE ISLAND CO., THE, Providence, R. I.
M. H. Bronsdon, Chief Engineer.

RICHMOND & PETERSBURG ELECTRIC RAILWAY CO.,
Richmond, Va.,
Calvin Whitely, Jr., Chief Engineer.

RICHMOND LIGHT & RAILROAD CO., New Brighton, N. Y.
Frank O'Malley, Chief Engineer.

ROANOKE RAILWAY & ELECTRIC CO., Roanoke, Va.,
John W. Hancock, General Manager.

ROCHESTER RAILWAY Co., Rochester, N. Y.,
I. E. Matthews, Chief Engineer.

ROCKFORD & INTERURBAN RAILWAY Co., Rockford, Ill.,
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ROCK ISLAND SOUTHERN RAILROAD Co., Monmouth, Ill.,
F. H. Lanchshire, Chief Engineer.

ROCKLAND, THOMASTON & CAMDEN STREET RAILWAY Co.,
Rockland, Me.,
Chas. E. Gregory, Chief Engineer.

RUTLAND RAILWAY, LIGHT & POWER Co., Rutland, Vt.,
Thomas L. Roach, Electrical Engineer.

SAGINAW VALLEY TRACTION Co., Saginaw, Mich.,
S. E. Wolff, General Manager.

ST. JOSEPH RAILWAY, LIGHT, HEAT & POWER Co.,
St. Joseph, Mo.,
R. A. Foresman, Chief Engineer.

SAN ANTONIO TRACTION Co., San Antonio, Texas,
G. H. Cushman, Chief Engineer.

SAN DIEGO ELECTRIC RAILWAY Co., San Diego, Cal.,
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SAN JUAN LIGHT & TRANSIT Co., San Juan, Porto Rico,
Lloyd Lyon, Assistant Treasurer.

SAVANNAH ELECTRIC Co., Savannah, Ga.,
F. M. Yawger, Chief Engineer.

SCHENECTADY RAILWAY Co., Schenectady, N. Y.,
B. Penoyer, Engineer.

SCIOTO VALLEY TRACTION Co. (THE), Columbus, O.,
Julian Greiggs, Chief Engineer.

SCRANTON RAILWAY Co., Scranton, Pa.,
A. S. Kibbe, Chief Engineer.

SEATTLE ELECTRIC Co., (The,) Seattle, Wash.,
Mark Lowd, Chief Engineer.

SHEBOYGAN LIGHT, POWER & RY. Co., Sheboygan, Mich.,
W. B. Voth, Chief Engineer.

SIOUX CITY TRACTION Co., Sioux City, Ia.,
M. W. Lake, Chief Engineer.

SOUTH CHICAGO CITY RAILWAY Co., Chicago, Ill.,
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SOUTHERN WISCONSIN RAILWAY Co., Madison, Wis.,
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SOUTH SHORE TRACTION Co., New York, N. Y.,
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SOUTHWEST MISSOURI RAILROAD Co., Webb City, Mo.,
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SPOKANE TRACTION Co., Spokane, Wash.,
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SPRINGFIELD CONSOLIDATED RAILWAY Co., Springfield, Ill.,
H. H. Jones, Chief Engineer.

SPRINGFIELD RAILWAY Co., THE, Springfield, Ohio,
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SPRINGFIELD TRACTION Co., Springfield, Mo.,
J. M. Brown, Chief Engineer.

Sterling, Dixon & Eastern Electric Railway Co.,
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A. L. Gillette, Electrical Engineer.

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G. E. Higgins, Chief Engineer.

Syracuse, Lake Shore & Northern Railroad Co.,
Syracuse, N. Y.,
Thomas H. Mather, Engineer.

Syracuse Rapid Transit Railway Co., Syracuse, N. Y.,
E. P. Roundy, Engineer.

Tacoma Railway & Power Co., Tacoma, Wash.,
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Tampa Electric Co., Tampa, Fla.,
H. A. Hampton, Chief Engineer.

Terre Haute, Indianapolis & Eastern Traction Co.,
Indianapolis, Ind.,
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Terre Haute Traction & Light Co., Terre Haute, Ind.,
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Toledo & Chicago Interurban Railway Co.,
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TRI-STATE TRACTION CO., Steubenville, Ohio,
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TRINIDAD ELECTRIC RAILROAD CO., THE, Trinidad, Colo.,
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TUCSON RAPID TRANSIT CO., Tucson, Ariz.,
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TWIN CITY RAPID TRANSIT CO., Minneapolis, Minn.,
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UNION ELECTRIC CO., Dubuque, Iowa,
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UNION STREET RAILWAY CO., New Bedford, Mass.,
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UNITED RAILWAYS & ELECTRIC CO., THE, Baltimore, Md.,
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UTAH LIGHT & RAILWAY CO., Salt Lake City, Utah,
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UTICA & MOHAWK VALLEY RAILWAY CO., Utica, N. Y.,
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VALLEY TRACTION CO., Chambersburg, Pa.,
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C. S. Kimball, Engineer.

WASHINGTON WATER POWER CO., Spokane, Wash.,
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WINONA INTERURBAN RAILWAY Co., Winona Lake, Ind.,
Chas. Sigler, Chief Engineer.

WINONA RAILWAY & LIGHT Co., Winona, Minn.,
Robert Paton, Chief Engineer.

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G. W. Dunlap, Superintendent Motive Power.

YEGAN BROTHERS POWER PLANT, Billings, Mont.,
J. E. Brayton, Manager.

YORK STREET RAILWAY Co., York, Pa.,
L. C. Mayer, Chief Engineer.

YOUNGSTOWN & SOUTHERN RAILWAY Co., Youngstown, Ohio,
Geo. Tod, Jr., Chief Engineer.

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(Arranged Alphabetically According to Names.)

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